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POPULAR AVIATION

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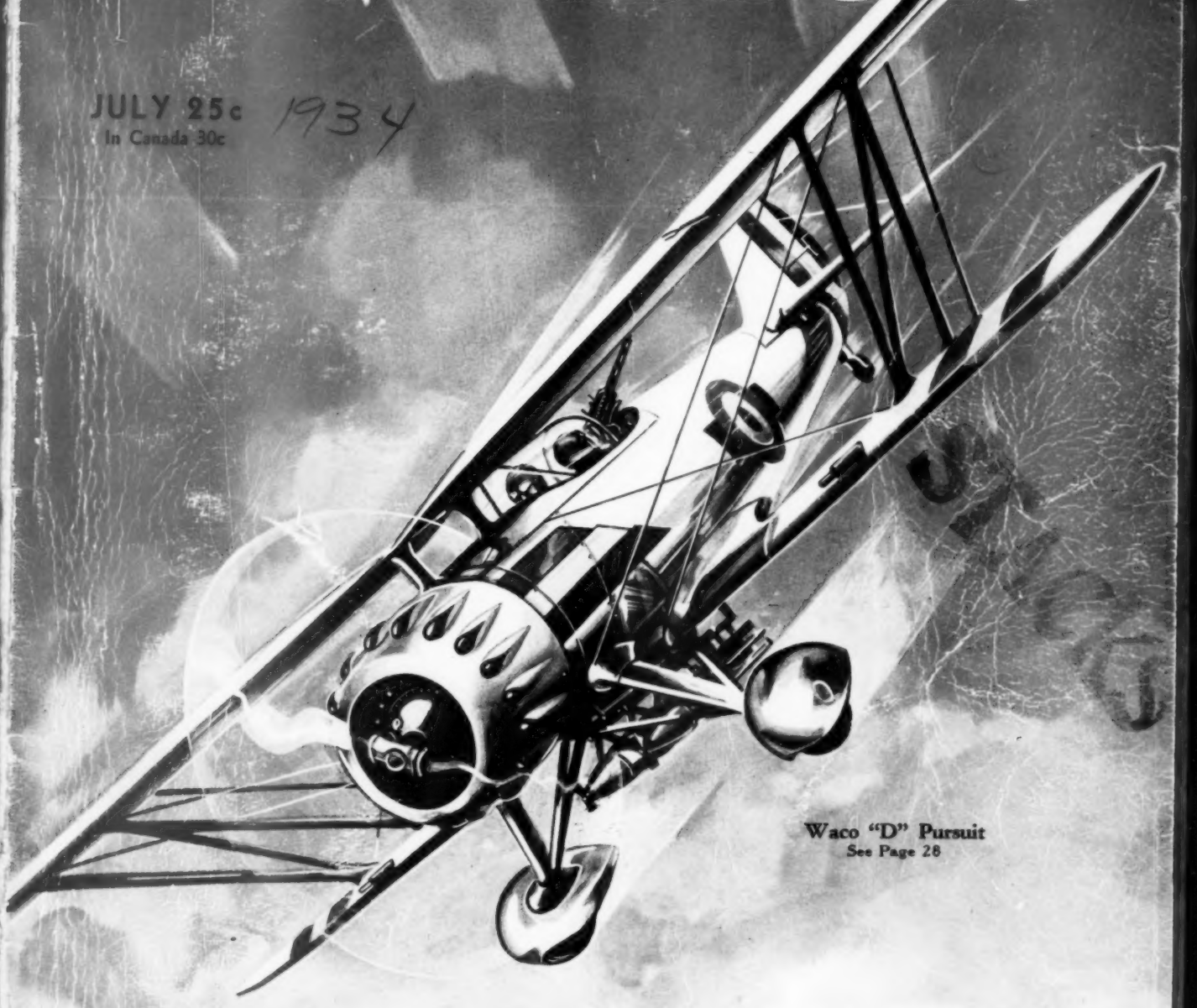

Waco "D" Pursuit
See Page 28

HERMAN R. Ballin

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An Airy Chat With the Editor

I TAKE great pleasure, this month, in introducing two of America's pioneers in aviation science and invention. I use the word "introduce" advisedly, for in spite of their many achievements, they are unknown to many of the present generation.

Folks, meet Capt. James V. Martin and Dr. Christmas, two of the most versatile inventors in aviation and who, unfortunately, were so far ahead of their time that they never reaped the rewards that were their just due. You'll find an account of each of these men in this issue which will prove a surprise to newcomers who believed that Lindbergh is responsible for the airplane.

* * *

SPEAKING about inventions calls to mind the fact that it does not pay to be too far ahead of your time. The best that the early-bird inventor can expect is long delayed applause. And in this respect I can name another early-bird in invention, Dr. Pratt of Chicago, who undoubtedly invented radio telephony in its present form, 'way back in the 80's, and who has never been given due credit nor compensation for his work. He was just 40 years ahead of his time—that was the whole trouble.

* * *

FOR those who believe that we should have cut-rate airmail service in the United States, we are printing an authentic story of the Imperial Airways, Great Britain, in this issue. This article shows how Great Britain is gaining aerial supremacy by extending a helping hand to the infant aviation via subsidies and similar financial life-savers. Instead of throttling commercial aviation, Great Britain is building up a surpassing air service to all parts of the world.

* * *

ALL you homebuilders and amateurs will be glad to hear that Verne Payne's miniature Knight Twister biplane has not only flown but has also shown fine performance. When the drawings first appeared in POPULAR AVIATION, the "wise ones" shook their heads profoundly and made disparaging remarks about the design. But here as everywhere, the proof of the pudding is in the eating thereof.

OUR local, self-appointed authorities, all wet as usual, predicted that the Knight Twister was so small that it would be tricky in the air and impossible to handle. Just the reverse was true (as usual) for the little ship with the 15-foot wing span flew "hands-off" in rough weather and proved a very easy ship to land. Give a great big hand to Verne Payne, fellows, he deserves it.

* * *

YOU see, it is this way. Our night-school aerodynamical experts can see that the aileron effect with a 15-foot wing is materially less than with a 30-foot wing, but at the same time they fail to recognize the fact that the inertia or "fly-wheelage" is also less, and that the natural period of the ship is so short that it is usually below normal gust frequency.

* * *

DO YOU remember the hot letter printed in the last issue? The letter from Mr. Loose, Bettendorf, Iowa, in which he violently attacked our stand on air-races? Do you remember that the writer said he'd send in a year's subscription to P. A. if we would print the letter?

Well, he made good and sent it. He says: "I take pleasure in enclosing my $2.50. Not because I am afraid of your threat, but because I never make bargains that I do not intend to fill." Fine. Spoken like a real guy.

* * *

CHICAGO, and many other points in the central states, has been the victim of a 30-day drought. A good 30 days without rain and with mighty little moisture, has done a whole lot of things to the unprotected unvarnished woodwork and plywood in airplane wings. Some of the ships now have either a lot more dihedral or a lot less dihedral than before they dried out and warped. And you should see some of the wiggly trailing edges! Next time, perhaps, the gang will pay more attention to moisture proofing these parts. Moisture can leave as well as enter wood.

* * *

MONTH after month we receive a great many letters requesting information about getting into the U. S. Army Air Corps. To save your postage stamps, we advise you to write directly to Office of the Chief, U. S. Army Air Corps, U. S. Army, Washington, D. C., for the very informative booklet, "The Flying Cadets of the Air Corps." This explains various matters concerned with entering the Air Corps, priorities, etc. But, in short, your cause is hindered by the fact that the service is endeavoring to build up an organization of flying officers rather than simple pilots, hence graduates from the U. S. Army Academy, West Point are given preference over civilians or other branches of the service.

* * *

MEASURING drift is still a matter of great difficulty in spite of the many systems developed up to the present time. All sorts of optical devices have been built to measure to side motion in a cross-wind, but all of them are difficult to read, even in the daytime, and are impossible at night. Here's a great big chance for you fellows to dope out something that is simple, accurate and cheap for measuring drift.

* * *

BOOTLEG FLYING—do you know what it is? Well, this consists of flying an unlicensed ship by an unlicensed pilot in defiance of the Aeronautical Prohibition Department, commonly referred to as the Dept. of Comm. There are no laws against handling dynamite, making arsenic acid, driving unsafe automobiles nor many other hazardous proceedings, but just let a poor amateur get caught flying without his licenses and he immediately becomes a victim of the wrath of the law. And this has led to "bootleg aviation."

* * *

WHAT America wants, in addition to a good five-cent cigar, is a cheap simple automatic pilot or "robot" for privately owned planes. This would also be a swell idea for school training planes on that first solo! So, when the student becomes fidgety, the robot cuts in and saves the school about $152.76 worth of crash. Here's another job for our inventors.

* * *

THEN, here is another suggested improvement. A two-handed easily accessible Pyrene fire-extinguisher adapted for socking a smart alec student while in mid-air. Stillson wrenches, pein hammers and bottles,

(*Continued on page* 52)

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XV JULY, 1934 Number 1

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Anthony H. G. Fokker

The Fokker D-7 was the outstanding enemy plane of the World War and had about everything that a pursuit ship should have during that period.

by
JAMES FARBER
Special correspondent for POPULAR AVIATION

THREE paragraphs express vividly the most significant phases in the life of Anthony Herman Gerard Fokker, the Flying Dutchman from Holland.

Quoting Fokker himself: "First, I offered my ship to England. I was turned down. Then to Russia and Italy did I go, yes, and even my own Holland, but was again disappointed. I was a neutral. I should have preferred the Allies to have my ship. But they said 'No' to me, so I went to Germany. It was accepted."

Tony Fokker said these words to this reporter. The second phase can be shown by a paragraph culled from one of the inexhaustible stories of world war aerial combat:

" . . . the R.F.C. pilot looked over his shoulder as his ship trembled under a rain of bullets. There, roaring down out of the sun, fire-red noses spouting flame, rode three Fokkers. In another minute. . . ."

These words briefly describe a drama that was enacted on countless occasions on whatever front Fokker planes were used during the war. Peace came and with it such newspaper reports as:

"Charles Kingsford-Smith and associates embarked on the first leg of their round-the-world journey today. Flying a giant Fokker powered with three motors, the party expects to. . . ."

Auspicious? Yes. But life really began for Tony Fokker when he was thrown out of school as a dunce!

Born in the jungle village of Kediri, Dutch-owned Java, on April 6, 1890, Tony Fokker was living the life of a barefooted little Tarzan of the forest primeval when other boys were learning their ABC's. He never had a pair of shoes on his feet until his father returned to Holland. Tony was then 6.

Whoever "invented" readin', writin' and spellin' must have seemed a fiend to young Fokker. Multiplication tables, when he finally got around to them in the neat little red schoolhouse in Haarlem, were about the only part of the curriculum that made any sense to him. He was early an adept in arithmetic and later, in mathematics. He could always remember figures and work with them—as long as they were on paper. It is that way even yet. He can do most anything with them that way but he can't even remember telephone numbers.

He became so alarmingly unproficient in the three R's that an exasperated teacher, after marking him as the classroom dunce, finally fired him.

His education, curiously enough, was finished with the highest marks given out. The amazement of his learned but somewhat obtuse instructors came to an end when Tony, on graduation, explained that he had bored a hole in his desk, inserted discs containing all the desired information and passed his exams with flying colors! It was too late to do anything about it. Tony had his education—even if most of it were on paper.

It was the first manifestation of his inventive genius that brought him to fame and fortune.

Wilbur Wright came to France and made a 31-minute flight. The event astonished Europe. Tony didn't see the flight but he heard about it. What a man, he thought. And what a field in which to work. Aviation would be his stamping ground. He had never seen a flying machine in the air but he set out to build one. He reasoned that the Wrights had been similarly handicapped, but they were flying. For the first time in his life he took to serious study—of machines and winds and physics—things he could understand—if he could reduce them to mathematical expressions on paper.

He built an airplane and it flew. It wasn't a very good machine, technically speaking. But it did do the thing it was built for, hence it was a success.

His skeptical Dutch neighbors gathered with shaking heads to watch the "crazy Fokker" fly his "bicycle egg-crate." As in countless cases through ageless time, the scoffers remained to cheer.

In those early days, Tony had two memorable accidents that preluded his role as a darling of Fame. On one occasion his lumbering craft was shivered by the explosion of its gas tank. He had to think fast—he could do it when he had to—to get out of that predicament. But he did. Another time while sailing over Johannisthal airport at Berlin, in 1911, a wing buckled and Tony and his passenger were injured, the latter fatally. Memory of that played the determining role in a drama in which he became involved that might have blasted his career.

Tony Fokker knew, when Germany invaded Belgium and when England declared war on Germany, that the time had come when airplanes would be put to the acid test. It would be his time, too, he believed. All the theories of the military and commercial value of airplanes; all the fanciful conceptions of the role of aeronautics in civilization were about to get their baptism of fire—and blood.

Wild with enthusiasm, Tony went to England. Austere war lords at the war office listened politely to his story and gravely turned him down. Somewhat chastened, Tony went to Russia, then to Italy and finally to his native land. A less determined Dutchman would have given up in despair and disgust. Fokker, instead, resolved to try Germany. Shrewd military visionaries in that country gave him the chance he needed.

Established in his tiny factory at Schwerin, in Mecklenburg, 250 miles from Berlin near the Baltic sea, Fokker began making his contribution to German arms. His planes were regarded as exceptionally airworthy and maneuverable. They were durable and fast. The young inventor began to acquire a reputation.

Then came a series of deadly blows aimed at the Imperial flying corps.

An unidentified Frenchman was stalking through the skies spreading death and destruction among any

the Flying-Dutchman

TAKE heart, you inventors, designers and builders of home made aircraft. The road is rocky and the dawn seems many hours away. But profit by the story of the world's best known designer and builder of planes. Be encouraged after reading of the difficulties that beset his path and would have disheartened many a brave soul. Study this review of the career of the inventor of the famed Fokker aircraft.

Anthony H. G. Fokker (left) is explaining an outstanding point in the design of a late Fokker transport.

groups of German planes he chanced to meet. In those days, planes were used chiefly for espionage over the German lines. Scouting and artillery control rounded off the list of functions of the air corps. When two planes met they were swung wildly at each other while the pilots engaged themselves in blazing away at each other with shotguns filled with bolts and scrap iron. Very few planes were lost in this clumsy fashion.

The stalking French terror of the skies, however, not only shot down his victims with a machine gun, but fired through his propeller blade as it whipped the air!

The Imperial Staff was incredulous, then angry, then frantic. The Frenchman must be captured. He was. But only because he was forced down in a fog one day back of the German lines. German infantrymen seized him before he could burn his plane. The secret would be a secret no longer. The pilot proved to be Roland Garros who had barnstormed the United States in 1911 with the Moisant troupe of flyers.

Knowing his inventive genius, Berlin military graybeards summoned Fokker to army headquarters. Here was the contrivance, they told him. What did he make of it? Fokker asked for time and the use of the captured gun. He rushed home with it and in 48 hours returned with a new device that was perfection itself, mechanically.

Like many strokes of genius it was simple. Fokker arranged his prop so that in revolving, a knob on one of the blades hooked up by a rod and knee lever to the trigger of the gun discharged the gun after the blade was past the bullet's path. Simple? Fokker says the solution came to him in a flash—in a split second.

Forgetting sleep and every other consideration except the revolutionary triumph he had achieved, Fokker tirelessly hitched a plane on the back of his automobile—with a machine gun mounted and synchronized on its nose—and burned up the roads between Schwerin and Berlin. He arrived excited and enthusiastic at Johannisthal airport and summoned members of the general staff for the tests.

He took his ship into the air, dove on the ground targets, shot holes through some and obliterated others, then came down for the verdict. The staff officers informed him that it was all very well done but there must be some trick to it. The only practical test, they stated, was to shoot down an enemy. If Herr Fokker would do that, the invention might be approved and used in quantities.

Fokker was staggered. What more proof did these military dunderheads require than that just provided? Angry beyond words, Fokker said he'd show them. Cold and suspicious, the officers told him to go ahead and provided him with a uniform and identification card lest he be captured and summarily shot as a neutral civilian not minding his own business. The card read:—

"Lt. A. H. G. Fokker
Born April 6, 1890."

Then the inventor started on his man hunt. He had not far to go before he spied a two-seater French observation plane peacefully cruising over German territory. Fokker, in the sun, banked his plane and let forward his control stick for the downward plunge. It would be all too easy.

Then into the mind of Tony Fokker there flashed a picture of that bitter day when he had carried a helpless passenger to his death. After all, what right had he, a neutral, to shoot down to their deaths two more helpless men? If those dunce military experts required this much proof he, Tony Fokker, would chuck the whole business and they could invent a synchronizer themselves.

He left the Frenchmen unsuspecting and unmolested. At Johannisthal he told the militarists in no uncertain terms that under the prescribed conditions he was through. The ultimatum was countered with an order forbidding him to leave the country although a concession would be made. Lieut. Oswald von Boelcke, crack pilot, would take Fokker's plane over the lines for the desired test. If successful, Fokker would be given the contracts.

Von Boelcke put it over. The little factory at Schwerin became a beehive of activity. It was enlarged to include

The Fokker tri-motor left a profound effect upon transport plane design. It is still used extensively in Europe.

an old military prison, new machinery was installed and more men came to work to turn out the miracle machines of military aviation. From a pay roll of 160, the number jumped to 1600.

It is no exaggeration to state that Fokker personally revolutionized air fighting. He introduced the personal element into aerial combat. Garros' machine gun was a crude means to a deadly end. Fokker's invention made the lethal process mechanically perfect.

With his device the German flying corps reduced its enemies to abject helplessness in the air. No French machine could withstand the assault of a Fokker plane with a nose spouting lead and flame. The skies were dominated by the Black Cross of Germany. The circular tricolor of France was blasted from the heavens and the Germans spied at leisure and at will on enemy troop movements with their supporting air forces utterly defenceless.

These statements are not overestimates. There are official records aplenty to show the horrible losses sustained by the French air service during the year 1915. Probably Fokker would never have considered leaving Germany had he not been suddenly ordered to stop manufacturing his own planes and start in on Albatrosses.

Once more he was amazed at the crass actions of his Berlin superiors. In view of his recent triumph with the synchronized guns, the matter demanded an explanation. About to ask it, he was further confounded by a military order creating him a German citizen and forbidding him to discontinue the manufacture of airplanes unless he preferred being sent to the front lines as a common soldier.

The illegal citizenship order didn't worry Fokker so much as the insult to his creative genius and his celebrated planes. He accordingly raced to the front line airdromes where he had many friends and asked them to "lobby" in Berlin for an army order giving pilots the right to choose their own ships. Since most flyers preferred Fokker planes, it was a foregone conclusion that Fokker would win.

The war office ordered a contest to be held to determine the best battle plane. Fokker entered an entirely new model, won the contest hands down, was re-awarded his contracts and saw his commercial rivals ordered to make Fokker planes. And that was the birth of the famed Fokker D-VII.

The inventor eventually learned the true reason for the drastic steps taken to keep him in Germany. German spies in England learned that the British government, anxious to obtain the services of the man whose plane was officially credited with fifty percent. of Allied aerial casualties, was about to approach him secretly with an offer of 2,000,000 pounds (about $9,500,000) to make planes for the side that spurned him. Fokker never received this offer. But the German government knew it

(*Concluded on page* 54)

This "Fleet" Is the Macon's Elevator and Tender

by D. F. MacLACHLAN

Who'd know this little 2-place Fleet biplane all equipped for hooking on the Macon? This is a new idea employed by the U. S. Navy.

SELDOM seen on the ground except at Moffat Field, Sunnyvale, Calif., and therefore seldom photographed because of the ban on pictures at the lighter-than-air base, this little Fleet biplane serves as a ferry from the ground to the dirigible Macon while she is in flight.

It used to drop and pick up passengers and small supplies. The hook for contacting the big Macon is plainly shown over the top wing, and hooking on is now accomplished with ease at any time and under most conditions. This calls for good climbing ability and low landing speed.

The First American Seaplane With Airbrakes

THE first seaplane manufactured in the United States equipped with wing trailing edge flaps, commonly known as "airbrakes", is now undergoing final flight tests before delivery to the Scadta Airlines of Colombia, South America, where it will fly on regular schedule over the Magdalena River, carrying passengers, mail and express.

This unusually clean transport airplane is a product of the General Aviation Manufacturing Corporation, Dundalk, Maryland, which is a subsidiary of North American Aviation, Inc., affiliated with the General Motors Corporation.

It is equipped with a Pratt & Whitney engine of 700 h.p. which drives an all-metal controllable pitch propeller. It has a twin float arrangement with specially designed bracing to meet operating conditions of the Scadta Airlines, and has a maximum speed of over 165 m.p.h. It lands at approximately 60 m.p.h. with the airbrakes, or flaps, in extended position.

Here's the new General Aviation seaplane, the first to be equipped with airbrakes.

Early Days at Hammondsport

by "STONEWALL JACKSON"

Interesting facts concerning the development of the early Curtiss seaplanes and flying boats on beautiful Lake Keuka, Hammondsport, N. Y. The author assisted in these early experiments.

TRUE to his inherent sense of values, Glenn Curtiss could see no practical advantage in stunting a plane. Whenever it was required to make a test flight on some new machine, he would take it to the East corner of the lake and put it through such evolutions as were necessary to determine its flying qualities and the way it should be handled; there was a sureness of touch and an economy of effort and motion in everything he did that immediately impressed the spectator with the fact that an expert was handling the controls.

If he was not satisfied with the performance he would fly the machine back to the hangar and make such alterations as he deemed essential, and forthwith the ship would be launched again for another trial. This process would be repeated a number of times, and only after he was quite satisfied with the results, as far as it was possible for him to feel that way, he would hand the machine over to the aviator who was to fly her. Curtiss never expected any man to fly a new machine which he had not first flown himself. There was nothing left to chance when G. H. was around.

Lincoln Beachey, of course, claimed exception to the rule, since stunting seemed to be second nature to him. He would come to Hammondsport once in a while, after spectacular exhibition flights in different parts of the country and honor the flying field with his presence for a spell. Being somewhat retiring by nature, as befitted the best flyer of all times, he was regarded as a demi-god by the aspiring novices. And like a demi-god, he was chary of words.

G. H. and Beachey were great chums.

We are looking at the first example of the early Curtiss "JN" series of which the JN-4 or historic "Jenny" was a descendant. Note the shorthorn skids.

They would wander around side by side through factory or field and at long intervals exchange a few monosyllables on subjects apparently too deep for words, or else they would pass the time of the day, (when not otherwise engaged, which was not often) playing golf on the aviation field, hopping school machines notwithstanding.

Beachey disliked hydros, the heavy pontoons making the machines too sluggish for his dizzy gyrations, although he would go up in them once in a while and treat the country-side to some rare stuff. And then there were those glorious days, few and far between, when Beachey would try out his reconditioned plane and overhauled motor and rip loose, usually ending the performance with the celebrated death-dive for which he was noted.

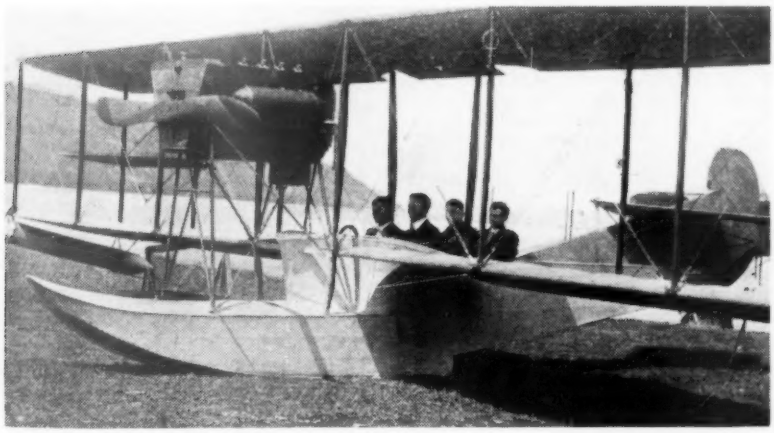
His first loop was tried at Hammondsport, first an outside loop which did not come off, then an inside loop which did. Many more looping flights followed after that, his ambition being to make a series of loops and finish the last one on the ground. He was told however that he was at liberty to do that stunt in any other place but Hammondsport, as he would be setting a bad example to the pupils and besides it would make such a mess. So he never tried it.

Beachey's performances may have been surpassed since by later flyers in high powered planes, yet it is our honest conviction that none of them could have equalled him on the primitive machines of that day. There never was one like him and never will be, which Curtiss contended "was a very good thing."

The year 1913 witnessed the establishment of the U. S. Naval Aviation Station on Lake Keuka, the station consisting of a huge tent (which the unsophisticated very pardonably mistook for a circus), intended to serve as a hangar for hydro-planes and boats soon to be acquired.

The personnel comprised Lieutenants H. C. Richardson, Ballinger, and Smith with a few petty officers and enlisted men, and with their arrival a new era was inaugurated in flying boat construction.

The flying boat was subjected to an exhaustive analysis by Lt. Richardson, a naval constructor of great ability, and the planing properties of the hull-bottom were thoroughly analyzed and tested in the Navy Model Basin at Washington, D. C. The flying boat was in fact, at once put on a scientific basis



This early Curtiss flying boat was purchased by Harold McCormick, wealthy Chicagoan, who used it for commuting between his Lake Forest home and his city office.

and many interesting factors were brought out.

Under Lt. Richardson's supervision a very efficient curve was imparted to the here-to-fore flat winged "V" bottom which greatly contributed to a quick take-off, and a type of flying boat was designed by him which differed from the Standard Curtiss boat in that the hull terminated squarely a short distance aft of the step while the tail surfaces were carried on outrigged trusses as used in the Curtiss land machines and hydro.

The hull was, moreover, provided with retractable wheels in water tight compartments. This arrangement making the first practicable amphibian flying boat on record. That it was satisfactory from an aquatic as well as from a land standpoint is borne out by the fact that Lt. B. L. Smith, U. S. N., succeeded in obtaining both his land flying license as well as his hydro license with this machine, both these test flights being made at Hammondsport.

Those familiar with N C boats which flew across the Atlantic after the war, constructed from designs by the then Comm. H. C. Richardson, will not fail to notice their general resemblance to the little amphibian built at Hammondsport, which was in fact their experimental proto-type. The internal construction of flying boats was also carefully analyzed with a view to improve their sea-worthiness, the results being apparent in the hulls of the large flying boats developed by the Naval Aircraft factory.

At the same time, some interesting experiments were carried out with wireless communication from planes in the air to a ground station and vice-versa, this feat being first accomplished at Hammondsport.

The Curtiss school-hydro also had the distinction of being the first plane in the world to be equipped with a gyroscopic stabilizer which was specially built for that purpose by the Sperry Gyroscope Company, the little gyroscope unit with its diminutive servo-motor being installed and hooked up to the controls by Lawrence Sperry who also tried the device out in actual flight.

Construction was started on the twin motored flying boat "America," quite an ambitious affair intended for the first non-stop flight across the Atlantic. This machine was finished and tested in 1914; the outbreak of the World War however, put a stop to the project and the hull design was subsequently modified to serve the Liberty motored HS2L boats of the war period.

Perhaps the most interesting experiment of all was the reconditioning of the old Langley machine, which was borrowed by Curtiss from the Smithsonian Institution in the interest of the Wright-Curtiss patent suit. The machine was provided with pontoons and flown over Lake Keuka by Glenn Curtiss himself, who thereby sought to demonstrate that the Wright plane was by no means the first practical man-carrying flying machine ever built.

Here we see Capt. Dodd using the early Curtiss shoulder type aileron control. The ailerons were actuated by side-to-side movements of the body.

Then the war broke out and further independent developments were set aside in favor of war-contracts and quantity production of training machines subject to an elaborate system of government specifications, individual effort thereby becoming subservient to national requirements. In every respect however all subsequent developments had their roots in the work done by Glenn H. Curtiss and his assistants during those few busy and fruitful years in Hammondsport.

This little history would not be complete, however, without some reference to the early control system of the pusher Curtiss planes. It should be noted, that during this period, interplane ailerons were employed and were operated by a novel "instinctive" control system.

The Curtiss shoulder control consisted of a chair with a pivoted back. The back, in turn, was provided with arms or bands that gripped the pilot's body in such a way that when he moved his body from side to side, the ailerons were also moved by connections to the chair back.

When the left wing went up, for example, the pilot instinctively leaned over toward the high side, and in so doing, turned the ailerons so that the attitude of the plane was corrected. A small steering wheel mounted on a staff, controlled direction while back-and-forth movements of the staff operated the elevators.

In conclusion we may ask: "Just what had Curtiss to go by when he started out on his remarkable career as an aeronautical pioneer and constructor? What in the way of training, data, precedent or science?" The answer is: "Practically nothing." Nothing tangible at least. Nothing but his innate shrewdness and common sense, his faculty of original thinking, a firm conviction that the ideas he conceived were feasible and could be carried out, and an inflexible determination to do these things the best he knew how.

Alcohol Fuel Data

IN many respects, alcohol is an ideal fuel for aviation engines but unfortunately it is too expensive to be a serious competitor of gasoline or other mineral fuels and it probably will always be too costly.

Its advantages may be summed up as follows: It is a clean fuel that leaves no carbon deposits in the cylinders, it has a high resistance to detonation, will withstand high compression pressures and burns without odor at the exhaust. Further, it has no diluting effect on lubricating oil and the oil remains in good condition longer.

But it has its bad features as well as good. Alcohol absorbs moisture rapidly from the air and therefore introduces objectionable moisture into the fuel system. It does not vaporize as rapidly as gasoline and this makes starting a difficult task. The moisture may be the cause of acid production which will adversely affect the delicate parts of the carburetor and fuel system.

To produce alcohol, it is necessary to grow starchy vegetables such as corn, potatoes, etc., and this is an expensive proceeding because of the great ground acreage required and the great amount of labor required for harvesting the crops. It is estimated that the amount of alcohol necessary for operating all of the present automobiles would require a much greater acreage than is now under cultivation for food.

According to estimates made by distillers, the cost of motor alcohol is equivalent to gasoline selling for 65c per gallon.

Flying Bugs

YOU probably never have taken a buggy ride in an airplane, but to pilots of the nation's air lines it's becoming a common enough experience.

For often the cargo of a commercial plane consists solely of bugs—not ordinary bugs, but tiny battlers that are saving money and trees for Florida horticulturists. Twenty thousand ladybugs were whisked away in one shipment from Sacramento, Cal., to Orlando, Fla., to quell a scale epidemic in citrus groves. Ladybugs, it seems, thrive on citrus scale.

Others, tiny parasites that can be seen only through a microscope, travel to Florida regularly. Each small package of them costs the grower $1, but figures show their average worth in combatting bug-infested trees is $29 a package. Their life is short, so they have to be transported in a hurry.

Lady Air Cops

THREE Washington, D. C., women have been appointed as special aerial police in the Washington District. They have been appointed by the Womens' International Aerial Police of the women's International Association of Aeronautics as a beginning in the formation of similar groups all over the country.

Up Where the Air Is Thin

by CHARLES L. BAUER

The latest stratospheric balloon adventure, sponsored by the National Geographic Society and the U. S. Army Air Corps, is extremely interesting from a scientific standpoint. Within a few hours the pilots expect to gather a mass of data on the upper atmosphere.

MAJ. WILLIAM E. KEPNER, who with another famous army flyer expects to rise higher this summer than anyone has ever penetrated, believes we have only "scratched the surface" in the conquest of the skies, and that some day men may view the earth from another planet.

Perhaps they will find other inhabitants on such a planet, and in that case the Martians or Venutians may compare notes with the voyagers:

"You say you come from the earth? Which star is that? Oh, the near star with the rings of light. Then there *are* dwellers on that star!"

Maj. Kepner plans to take off in the largest stratospheric balloon yet built from some point along the east base of the Rocky mountains. With him will be Capt. A. W. Stevens, who not only is the outstanding aerial photographer of the Army Air Corps, but less than six years ago broke the existing altitude record for airplanes by rising almost seven miles over Dayton.

He will be photographer and observer on the flight, to be followed by another flight in September. Maj. Kepner, who will pilot the huge bag, gained distinction as winner of the 1928 international balloon race. He has risen more than five miles in an open balloon.

"It is not unreasonable to believe that the earth does not appear to be just another star, if seen from a distance," Maj. Kepner says. "Looking at the earth from another planet we might see it, with the north or south pole as the center, circled by concentric light rings of varying color or intensity.

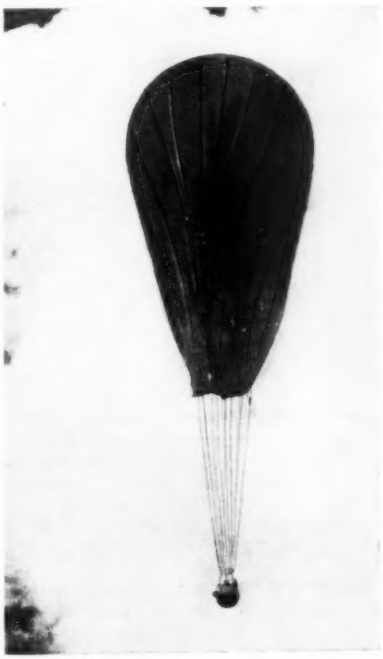
"The rings are due to the belts of gases and perhaps other substances, that compose the terrestrial envelope. We hope to pierce the envelope to a height of 15 miles."

The flight is being sponsored by the National Geographic society and the U. S. Army Air Corps. The balloon is expected to drift 600 miles eastward, by north or south, in the 12 or 13 hours between leaving and returning to earth.

More definite information as to the nature of the earth's gaseous jacket is one objective of the flight, Kepner says. Six evacuated containers in the top of the gondola will be opened at varying heights for samples to be analyzed afterwards, and a special container for an ozone specimen, to be taken at the "ceiling," is being developed. Ozone, an unstable form of oxygen, breaks down into simple oxygen under earth-surface conditions, and heretofore all such samples were practically valueless for that reason.

The flyers are not minimizing the danger they face in venturing into the stratosphere. Fresh in their minds is the fate of the Russian stratospherists, who hurtled to earth in their metal ball after announcing joyfully to the world, by radio, that they had reached a level nearly 12 miles above the earth.

Maj. Kepner seriously estimates that if the gondola becomes detached from the bag in any manner from a considerable height, it will be futile for him or Stevens to try to get out through the hatches.



The enormous balloon to be used on the National Geographic flight.

"We will wear parachutes, but we don't think they would help us if that happens," Kepner explains. "The parachutes may come in handy in case of trouble at lower levels. But if we tried to escape from the gondola in a long fall, in a few seconds we would find ourselves racing earthward at a speed of 500 miles an hour, and our backs would be broken before we could get out."

If a seam of the bag were to rip, the result would likely be disaster, Kepner thinks. For the cloth is put together in one great sphere, without separate gas compartments, and its contents would escape instantaneously.

Then, too, as long as the craft is in the troposphere, lightning and strong winds are a menace. Maj. Kepner recalls that once, in a balloon race, his and several other balloons were brought down by a terrific electrical storm. One man was killed and another, struck by a bolt, was thrown against the side of the basket. The lightning passed through his body and out by means of a metal ring around the inside of the basket. The ring was fused against the airman's body.

To keep the air in the gondola as like that at the earth's surface as possible, liquid oxygen will be spilled on the floor from time to time. As it evaporates, the liquid will oxygenate the air. The proper pressure will be preserved by releasing the contents of pressure tanks.

Maj. Kepner, who wears the croix de guerre and other decorations he won as cavalry officer in the World War, was sitting in his office at Wright Field, in his breast-spangled uniform, when we called. Capt. Stevens, clad in jumpers, was busy at work in another part of the material division administration building. After describing preparations for the flight, the major indulged in a bit of speculation. We asked him what he thinks lies beyond the "ceiling."

"Nobody knows that," he said, "but I have an idea that the earth, if seen from another planet with the north or south pole as the center, appears to have belts, or rings, formed by reflected light from the different gases. From other angles, the earth probably does not show these rings, because we know that at the poles the gas jacket is rarer, and for one thing there is very little water vapor in the polar atmosphere."

Water vapor, which is found in some degree all the way to the stratosphere, a height of about 6.2 miles in the temperate zones and about 9.3 miles in the torrid, forms the earth's nearest band of light rings, Kepner thinks. This is the area in which clouds are formed and the winds sweep, and the higher one goes the colder it gets. Temperature readings at the top of this area, called the troposhere, show an atmospheric temperature of –67°F.

The troposhere consists, besides a small percentage of water vapor, almost entirely of nitrogen and oxygen, the former comprising 78 and latter 21, percent. of the total. This nitrogen-oxygen ratio persists to a height of almost 25 miles and forms, Kepner thinks likely, the second ring visible from another world.

Above that height, the percentage of hydrogen increases, crowding out the nitrogen and oxygen. At 50 miles hydrogen fills about 65 percent. of space and at 70 miles, meteorologists think, there are only traces of nitrogen and helium and the rest, nearly 99 percent., is hy-

drogen. The hydrogen ring would be the third.

From this point upward, what surrounds the earth is almost an utter mystery to scientists. They are less concerned with the nature of the gases than the evidence that somewhere in the higher reaches, it is warmer than the earth's surface on a summer day.

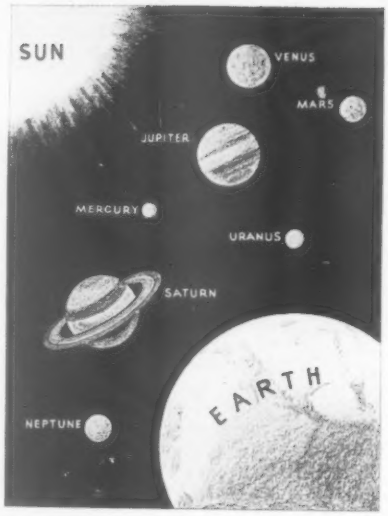
One thing of which they have definite proof, Maj. Kepner points out, is the gradual increase in temperature as one rises higher in the stratosphere. For a long time scientists have known that it does not get much colder than -67°F. in the stratosphere. That was why they called it the "isothermal," or "same-everywhere-temperature" region. But now they know, since Piccard's and later stratosphere flights, that from a height of about eight miles, in summer, the temperature rises as one goes higher, from -67°F. to -62°F. at 12 miles.

Prof. W. J. Humphreys, of the United States weather bureau, who Maj. Kepner believes knows more about meteorology than anyone else, and whose textbook, "Physics of the Air," he used when he taught a lighter-than-air class at March Field some years ago, thinks that the temperature increases to plus 120°F. at some undetermined altitude.

Maj. Kepner accounts for such a high temperature by the theory that the stratospheric gas, or gases, at that level are ionized by the bombardment of the sun's unfiltered rays, producing a release of energy sufficient to raise the temperature that high. Ordinary sunlight as it reaches the earth is filtered of its short-wave ultra-violet content—strong enough to kill—by an "armor" of ozone.

How high this ozone extends into the stratosphere, neither Maj. Kepner nor Prof. Humphreys has any idea. When, two months ago, Maj. Kepner discussed the matter with Prof. Humphreys, the latter simply shrugged and smiled. He does not know, he said. Perhaps, some day, when a stratosphere flight

The pilots just before taking off on a previous high altitude flight, showing the protective garments.



How the earth and planets will appear from the stratosphere.

can be made 25, 50 or 100 miles, this and other secrets will be unfolded, but for the present science must be content with speculation.

Then, we ask Maj. Kepner, why not make this flight higher than 15 miles?

"The size of our bag, 3,000,000 cubic feet, is carefully estimated to carry us between 70,000 and 80,000 feet," he explained. "The law of gases shows that if we increased the size another 1,000,000 cubic feet, we would gain only a few thousand more feet. It would not be worth the difference."

One factor of perhaps greater importance than any other is the decreasing outside pressure as the flyers ascend. As the pressure of the stratosphere decreases, pressure of gas inside the bag causes great expansion. To allow for this, the bag will be only seven percent. inflated at take-off, containing just 210,000 cubic feet of hydrogen.

At 70,000 feet, the outside pressure will be only 4.6 percent. that of sea-level and the bag will not only have expanded fully, but some of the gas will have to be permitted to escape to keep it from bursting. Temperature is another factor of importance. The bag constantly absorbs heat from the sun's rays. With every five percent. increase in the temperature of the gas, it expands one percent. Maj. Kepner expects that the hydrogen will pick up fully 100 degrees temperature in this manner, an expansion increase of 20 percent.

This is the reason the flight must be completed from sun-up to sunset. With the loss of this heat, at night, the hydrogen would contract between 15 and 18 percent., and the diminished lifting power would force the bag earthward. To offset this tendency, the flyers would find it necessary to release much of their precious ballast, on which they are relying to ease the shock of landing.

In all, they will take 7,000 pounds of

(*Concluded on page* 48)

Independent Lighting Units

A VERY ingenious airport lighting system has been recently introduced which requires no expensive cables nor conduits, yet at the same time, gives adequate lighting for airports.

The secret of this new system lies in the use of independent lighting units which consist of low energy neon lamps operated from six volt storage battery current. The local batteries are contained within the unit. Neon tubes take very little current, and depending upon conditions, no battery charging will be required within a six month period.

These lights are approved for use as boundary, runway or obstruction lights and being portable, they can easily be transferred to new positions when required. The cost is from one-third to one-quarter the initial cost of previous systems of the wired or conduit type, and the operating cost is correspondingly low. Flashing neon lights, operating at from 55 to 60 flashes per minute, can be operated at a cost of from one to two cents per day.

Tests for visibility by the Department of Commerce, indicate that these flashing signs serve their purpose and can easily be distinguished from surrounding illumination. They can be furnished to provide either a red or green light.

A Two-Stroke Engine for Lightplanes

A SMALL two-stroke powerplant for light airplanes, containing only nine moving parts and doing away entirely with valves, push-rods and rocker-arms, has been designed by Leland L. Scott of Kansas City, Mo. Very complete scavenging, or exhaustion of the burned gases, is among the important features.

The engine is said to be well adapted to the use of oil for fuel. The weight for the small engine is two-pounds per horsepower. Larger sizes, the designer contends, will come under one pound per horsepower.

Petroleum Aids Byrd

ADMIRAL RICHARD E. BYRD'S expedition to the South Polar regions is literally conducted on a cushion of petroleum. Every moving implement of the expedition is dependent on "black gold" or its components, ranging from the big Curtiss Condor and its fellow aircraft, including an autogiro, down to snow-sleds and electric light plants.

These petroleum products went South with the Byrd party: 5994 tons of fuel oil, 14,950 gallons of aviation gasoline; 800 gallons of lubricating oils; 3000 gallons of regular gasoline; 1500 gallons of kerosene; 25 pounds of aero rocker arm grease; 30 tons of Diesel engine fuel oil; 200 gallons of Diesel engine lubricating oil; 600 gallons of cylinder oil; 6250 gallons of marine engine oil; 230 gallons of rod swabbing oil, and 400 pounds of cup grease.

Biography of the British S.E. 5

by GEORGE HURST

A few pointers on the famous British World War pursuit plane developed by the Royal Aircraft Factory, known to all as the S.E.5. Its neat trim appearance has made it a favorite among model builders.

WELL, you aviation fans, we're off to take a peek at the war behind the front during those hectic days of '14 to '18.

We'll forget the flyers for the time being and watch the designers on both sides of the fence carry on their own quiet war, but none the less highly important war, with drafting instruments instead of machine guns. A pilot's ship, aside from the human factor involved, either carried him to victory or put him in a pine box for his failure.

A Camel pilot was adept at the quick maneuvers of the old merry-go-'round of turns and banks. Spad pilots were at their best in long power dives and quick pull-outs. Change ships on these two schools of pilots and they had to change their technique and change it quick. Mighty embarrassing for the wings to drop off and leave you in a Nieuport when you were trying to beat a D-7 at its own game of vertical power-diving or trying to out-rudder a rotary type triplane with a Spad.

The technical lads had a terrific sense of humor. Always pulling jokes on each other. Tony Fokker started the ball rolling in 1915 when he took one of his early monoplanes and mounted synchronized machine guns on the cowl.

The English boys came back at him with their pusher scouts and the French chipped in scout-planes with the guns mounted to fire over the top of the propeller arc. While the Allies were busy doping out a front fire device, the German Albatross firm stole a march on them and put their latest pursuit jobs on the line about six weeks ahead of time. As a result, the Central Powers wreaked havoc during April of 1917.

April of that year was quaintly and very appropriately dubbed "Bloody April." In May, the Camel and S.E. 5 made their appearance and put the Allies back on equal footing. Late model Spads, Nieuports and many Sopwith jobs followed in swift succession. Fokkers, Albatross Scouts, Halberstadts and Rolands met them . . . . . and they mixed it up until the whistle blew.

Many good men died. They did their best courageously on whatever equipment they had. The designers gave their best in the attempt to produce fine fighting craft. Honor is due both.

Let's take one of the Allied creations and see how it stacked up in the way of performance. Probably the best known and least understood pursuit plane of the war was the S.E. 5, manufactured by the Royal Aircraft Factory, England, and also produced with minor changes in the United States. As, has been stated, it first appeared on the front in May of '17 to meet the Albatross D-3 and Fokker D-4's that were sweeping the skies. It caused quite a bit of concern in German quarters and with mighty good reason.

A view of the British S.E.5. in full flight. Note the deep dihedral angle characteristic of the British fighting planes during the war and after. This little ship is unusually clean cut and streamlined.

The Royal Aircraft Factory, after a session at the drafting board, took some linen, dope, wood and steel and made wings for a biplane with an overall equal span of 26′-9″ and a chord of 5′-0″.

They made the fuselage 20′-10½″ long and stuck a radiator in front that made it look like a nickel cracker box and put a Hispano Suiza in back of the radiator that swung an 8-foot single-bladed prop. The landing gear was shoved far back under the body causing the S.E. 5 sit high in front, and giving it the appearance of a bantam rooster spoiling for a fight.

Maneuverability — excellent maneuverability—was built into her. Then, so she could mix it up with the high dive fellows they made her strong and gave the wings ten degrees of dihedral for stability in a dive. The safety factor, has been said to be 15, but I won't vouch for it.

The S.E. 5's zooming characteristics are proverbial. The old plane could pull out of a fast dive and go up like a skyrocket. A dangerous opponent. The 150 horsepower Hisso was first installed, followed progressively by the 180, 200, 220, and 240 models.

Well, let's see what Wilbur Wright Field says about this ship . . . and by the way . . . these tests are upon the English production and not the American.

"Powered with a 180 h.p. Hispano Suiza it had a maximum speed of 123 m.p.h. and an initial climb of 1,170 feet per minute. 6,500 feet were reached in six (6) minutes and fifty (50) seconds. The speed at this level, 118.5 m.p.h. Time to 10,000 feet, eleven (11) minutes and thirty-four (34) seconds."

Speed at 10,000 feet was 115.5 m.p.h. which was not half bad. To 15,000 feet in 21 minutes and 20 seconds with the Hisso dragging her along at 107.5 m.p.h. She climbed to 20,000 feet in 51 minutes, 17 seconds. The speed was now down to 85 m.p.h. at this high level. The service ceiling was 19,400 feet.

Naturally, the S.E. 5, had her bad points. She was a tricky little outfit and was liable to nose over on landings, due to the undercarriage being set so far back . . . . . but she was made for war and she waged a good one. The cockpit was a bit cramped, making it uncomfortable for the long boys. A Vickers was mounted on the left side of the cowl and generally a movable gun was mounted on the center section. But to simplify.

Let us say that an Albatross D-3 is riding an S.E. 5 pretty hard. Down drops the S.E. 5 with motor full on. Right after him comes the D-3. The nose of the "5" comes up and above the horizon suddenly and up she goes in a sky-rocketing zoom. But the heavy Mercedes pulls the Albatross on down and after a tussle it comes out of the dive only to find the English ship with the advantage of altitude and position. That's one way to tell it.

The Versatile James V. Martin—Inventor

by A. M. ALLAN

ONE of our earliest American aviation inventors, (Capt.) James V. Martin, was years and years ahead of his time in regard to the construction of airplanes.

Very recently, we obtained the following list of his best known patents and a glance at the table will show that Martin anticipated nearly all of the prominent features of the present day airplane which newcomers to aviation believe to be modern improvements. The patents listed are numbered to correspond with the various parts shown on the attached sketch.

The double convex wing, for example, now used on many planes and of which the wing-section M-6 is a prominent example, was patented at an early date by Martin. The same is true of the retractable landing gear, stressed skin wing and so forth. And yet, Martin is a man who has received very little recent publicity and who is little known even to men now engaged in the aeronautic industry. He well deserves a niche in the hall of aeronautical fame for his many inventions and experiments.

The Queen-Martin tractor biplane was the first tractor biplane built in the United States. It was exceedingly stable and at one time held the world's speed record, Martin taking the record from T. O. M. Sopwith in 1911. So stable was this ship that there was no need for the ailerons in ordinary weather.

* * *

A LIST OF EARLY MARTIN PATENTS

1. **Double Convex Wing.** Patent No. 1,400,177, applied for, Nov. 1917. Flown by W. B. Stout, 1918, McCook Field. The modern wing-section used on nearly all modern planes.
2. **Interconnected Trailing Edge Ailerons.** Patent applied for, 1911. Flown by C. Grahame-White, London Airdrom, March, 1911. These ailerons are used on all modern planes.
3. **Tail Decalage,** providing longitudinal stability. Patent applied for in 1911. Flown by J. V. Martin, Mineola, L. I., N. Y.
4. **Safety Motor** that saves 49 out of 50 forced landings. Patent No. 1,770,937, issued 1930. Tried on European flights.
5. **Stressed Skin Covering.** Patent No. 1,847,094, filed June 6, 1928. Now used by Junkers, Caspar, Seversky and others.
6. **Internally Braced Bi-Convex Wings.** Patent still pending, filed May 3, 1919. Second Patent No. 1,627,191, filed 1927. Used on cantilever type wings and flown on a Stout MI, 1918. Now used on Junkers, Boeing, Glenn L. Martin and Lockheed planes.
7. **Universal Vision.** Patent No. 1,492,304, applied for 1918. Built by U. S. Army and flown at McCook Field. Used on recent army pursuit ships.
8. **Streamlined Lights** on wings. Patent No. 1,627,191, filed March 5, 1921.
9. **Double Convex Internally Braced Tail.** This embraces cantilever type internally braced tail surfaces. Patent No. 1,429,518, filed 1924. Flown by Lt. Gerhardt, 1919 at Dayton Golf Club.
10. **Shock-Absorbing Rudder.** Patent No. 1,464,209, filed 1918 and flown by Lts. Schroeder and Gerhardt. Used on Gee-Bee, Vickers, Bristol, Sversky, etc.
11. **Retractable Landing-Gear.** First Patent No. 1,306,768, filed June, 1916. Followed by five other patents on retractable landing-gear. Flown by Lt. Gerhardt, 1919. N.A.C.A. Report No. 456 shows a 50 percent. reduction in resistance. Used on Loening and Bristol amphibians, on the Condor and Boeing ships.
12. **Ring-Cowling for Engines.** Patent applied for in 1911. Flown by J. V. Martin, 1911 on Long Island. N.A.C. Report No. 436. Now used on nearly all radial air-cooled engines.
13. **Detachable Engine Mounting.** Patent No. 1,603,134, filed 1921. Army and Navy specifications.
14. **Split-Axle Type Landing-Gear.** Patent No. 1,306,768, filed June, 1916. Tried at McCook Field, 1921. In 1918 Army Reports, A.D.M. 540. Used on Condor, Ford, Boeing Fokker.
15. **Control Neutralizers.** Patent No. 1,302,947, filed 1916. Flown by J. V. Martin, Mineola, L. I., N. Y.,

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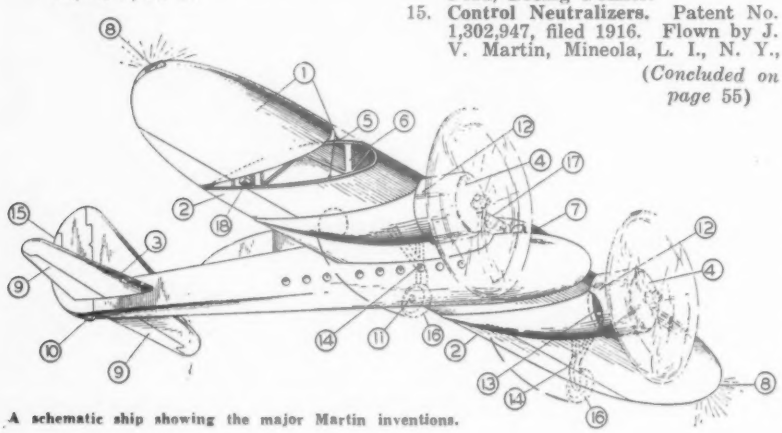


A schematic ship showing the major Martin inventions.

J. S. Charles Has Wide Experience

J. S. Charles, transport pilot.

PILOTING a plane has furnished J. Shelley Charles with a wide variety of experiences. Born in Winston-Salem, N. C., August 1, 1900, J. Shelley learned to fly in 1920 with the U. S. Army at March Field, Riverside, Cal., and received advanced training at Mather Field, Sacramento, Cal., on forest fire patrol until discharged from the Army as Lieutenant in reserve.

Following his discharge from the Army, barnstorming claimed Charles' attention and at one time he was a stunt performer with Mabel Cody's Flying Circus.

He finally grew tired of the nomadic life and looking for a permanent place, selected Richmond, Va., where in his flying school at Charles Field many Richmond pilots were taught the art of flying. He also had an airplane agency and probably sold more airplanes in the Middle Atlantic States than any other individual during the aviation boom days of 1927-1929.

Charles joined Eastern Air Transport December 1, 1930, as passenger pilot on the Richmond-Atlanta run, on which he is still flying. He now has had more than 5,000 hours in the air and has participated in two transcontinental air races. He is a member of the Caterpillar Club.

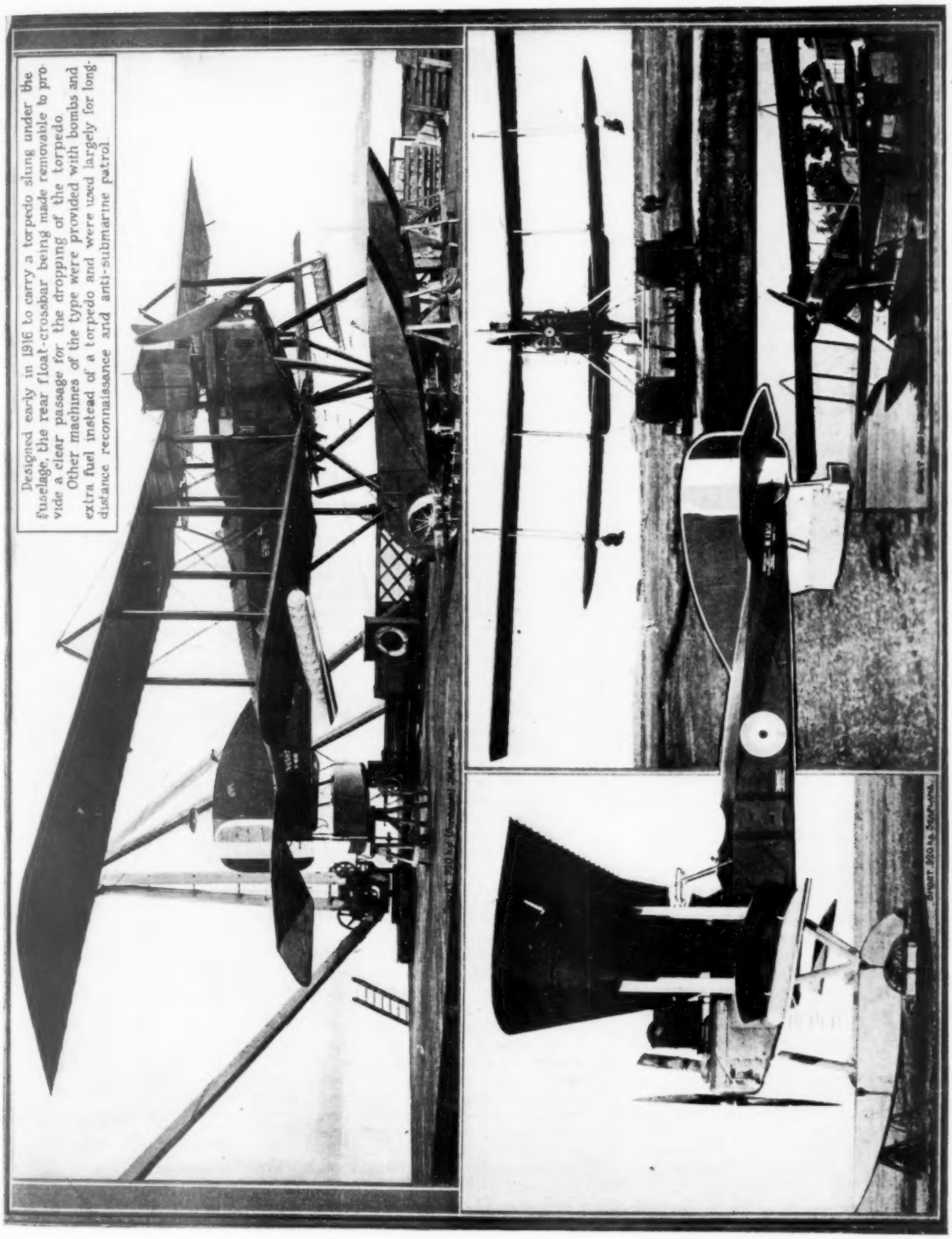
Lockheeds May Enter Australian Race

WITH one new Orion already crated and shipped to France and several Orions and Vegas being given a thorough going-over, several Lockheeds are expected to enter the MacRobertson International Air Races that will be flown from England to Australia next October.

The races are expected to develop a spirited competition between American and European planes and piloting skill. It is rumored that several of Europe's well-known pilots will be flying American-built airplanes when the race starts.

A Seaplane Photo for Our Photo Fans

An early Short Brothers torpedo carrying seaplane for service in the World War. It was equipped with a 320 h.p. engine which drove it approximately 100 m.p.h.



Designed early in 1916 to carry a torpedo slung under the fuselage, the rear float-crossbar being made removable to provide a clear passage for the dropping of the torpedo. Other machines of the type were provided with bombs and extra fuel instead of a torpedo and were used largely for long-distance reconnaissance and anti-submarine patrol

Shooting With Movie Film

A Fairchild camera gun, flexibly mounted on a Curtiss Falcon observation plane. This camera looks exactly like the real machine gun.

by
A. M. PENDLETON

Expert on the design of range-finders and other optical devices.

UP to and within a comparatively recent date, the target practice of aerial machine gunners was confined to stationary ground targets or to the slow and unmaneuverable sleeve targets towed by a plane. Under such conditions, the gunners received no combat experience such as would occur under war conditions.

But now we have the camera machine-gun that has solved the problem of aerial combat gunnery and made it possible to record the exact effect of each "shot" upon a strip of movie film. The camera machine-gun, be it understood, is simply a special camera that photographs the image of a reticle (target bull's-eye) simultaneously with the image of the "enemy" or target aircraft so that the two superimposed images exactly indicate the location of the "hit"—just as if a bullet had actually been fired. Study of this film record, therefore, enables the gunners to greatly improve their skill.

With the camera guns, the aircraft can enter into mock combat and all sorts of combat maneuvers with the assurance that a complete record of the shots will be preserved. The efficiency of this practice is still further advanced by the fact that the cameras exactly resemble a machine-gun in appearance, in mode of operation and action. So far as the gunner is concerned at the moment, he is firing a real service type machine gun in a dog-fight or other maneuver. The camera weighs the same and is placed upon the same mounts as a standard gun.

The United States Navy has adopted the Fairchild CG16 camera gun as standard equipment, and the device has also become a factor in aerial gunnery training in a dozen air forces throughout the world. It provides more economical training than would be possible by the firing of actual guns, and for this reason, the low cost of the gunnery drill permits of more frequent practice than would be possible in any other way under the present curtailed army and navy appropriations.

Like other camera guns, the Fairchild camera gun is basically a motion picture camera that takes successive photographs at the rate of 16 pictures per second as long as the trigger is depressed. After the "battle," the film is developed and then is projected on a screen or in a film viewing device—one picture at a time. On each of the picture spaces or "frames" appears the reticle system of sights (circles and cross-hairs), the target if it should be in frame and also the dial of a watch which indicates the exact time at which the shot was made. The gunner showing the earliest hit in a vital point is, of course, the victor.

When the film is projected before the crews of the competing aircraft, the faults or merits of the firing can be quickly and graphically indicated on the screen. Corrective methods can be pointed out and technique improvement can be presented with maximum understanding. It makes no difference whether a single shot (single picture) is shown or whether a "burst" is indicated by a number of pictures taken in succession, the picture still unfailingly depicts just what happened to each shot—and when.

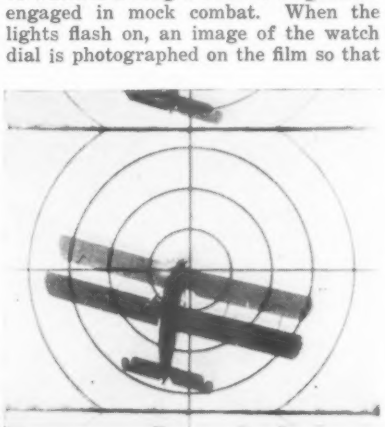
The new Fairchild camera gun shows many improvements, such as the use of a highly improved lens that admits much more light than the conventional lens, the use of 16 mm. film instead of the larger and more expensive 35 mm. film previously used, and an improved method of loading the gun with film. The lens is of the fixed focus type, hence the only adjustment to be made is the setting of the iris diaphragm for the regulation of the light.

By the use of the new high-speed lens, made possible by the use of the smaller film, the new gun can be used under a wider range of lighting conditions than possible with the older guns. Gunnery practice can therefore be carried on without waiting for a bright clear day and without limiting the practice to a few mid-day hours as has previously been found necessary. It may even be used early in the morning or late in the afternoon when the light is lacking in "kick."

The fact that the new lens has a speed of F3.0 instead of F4.5 or F5.6, as with other guns, is sufficient evidence to support the statement in respect to its use in faint light. Faster shutter speeds are possible with the F3.0 lens, and with faster shutter speeds comes freedom from blurring when the targets are moving at high speed.

Firing controls are of three types. First, the manual trigger system, and then remote control, mechanically by a Bowden wire, or electrically by a solenoid. When the trigger is released at the end of each "burst," the watch is photographed, thus giving a definite record of the time, down to a fraction of a second.

The watch, provided with hour, minute and second hands, is located in the front part of the camera and is illuminated at the end of each burst by four small battery operated incandescent lamps. The watch is provided with a stop which permits the synchronizing of watches among a number of gunners engaged in mock combat. When the lights flash on, an image of the watch dial is photographed on the film so that



Caught on the cross hairs of the reticle! The target will suffer a damaged wing—theoretically.

Instead of "M. G." Bullets

THE camera machine-gun permits of actual combat practice and maneuvers which, of course, is impossible with the actual machine-guns. Each hit landed during combat is accurately registered on movie film for future reference so that the results of the "battle" can be easily determined. Like its machine-gun prototype, the camera can take single "shots" or fire bursts of a number of pictures in rapid succession.

the exact time of the burst is beyond dispute.

The data card, or identification card, is also photographed at the same time, the name of the gunner and the date being usually set forth in this space.

All of the camera mechanism is in one compact unit which can be removed as a whole from the camera. It is independent of the lens but contains the rotary shutter and the small glass plate on which the reticle circles and cross-lines are engraved. This plate comes between the shutter and the film so that the image of the reticle is impressed upon the film at each opening of the shutter. At the rear is an opening for the insertion of the film magazine which is as simple as the insertion of a clip of cartridges into an automatic pistol. On the left hand side of the case is the winding key and gear that drives the film consumption indicator that shows how much film has been used. At the right is the button by which the shutter speed can be adjusted to either 12 or 16 exposures per second.

From the reticle, it is possible to tell the position of the target in respect to the path of the imaginary bullet and amount of "lead" allowed by the gunner to compensate for the relative velocities of the aircraft and bullets. The distance from the gun to the target can also be determined providing the dimensions of the target are known. This information is of great value in training a gunner, for his mistakes are shown clearly.

Super-speed panchromatic film can be supplied in metal magazines ready for insertion into the camera or on a special core without the magazine. The magazines are strong enough to be used repeatedly, hence they can be more cheaply reloaded from the core by the darkroom personnel than by purchasing the complete magazine. The film in either case is supplied in 25-foot lengths, sufficient for 1,000 shots or a total of 56 seconds of firing.

After the exposures have been made, the magazine is removed and the film is developed in the laboratory. The new magazine is quickly slipped into place by the gunner, going into position automatically, and the battle goes on. The use of this magazine eliminates the old difficulties of threading the film in the camera, an operation that took time and which frequently spoiled records.

The gun case can be mounted in a ring or post type of gun-mount for manual operation as a flexibly mounted gun or on a fixed mount for use as a fixed gun. In the latter case it is operated by Bowden wire or electrically. It will fit directly either into Browning or Colt machine mounts. Flexibly mounted, the standard type of spade grips are used, but it is a simple matter to change the mounts and controls as all parts are interchangeable.

A bead-and-ring type sight is used with the Fairchild camera-gun, the ring being fitted with the conventional cross-hairs when the gun is to be mounted flexibly and also in some cases, when mounted rigidly. However, when the camera gun is rigidly mounted, so that aiming is performed by aiming the airplane at the target, a bore-sighting unit is generally preferable to the bead-and-ring sight.

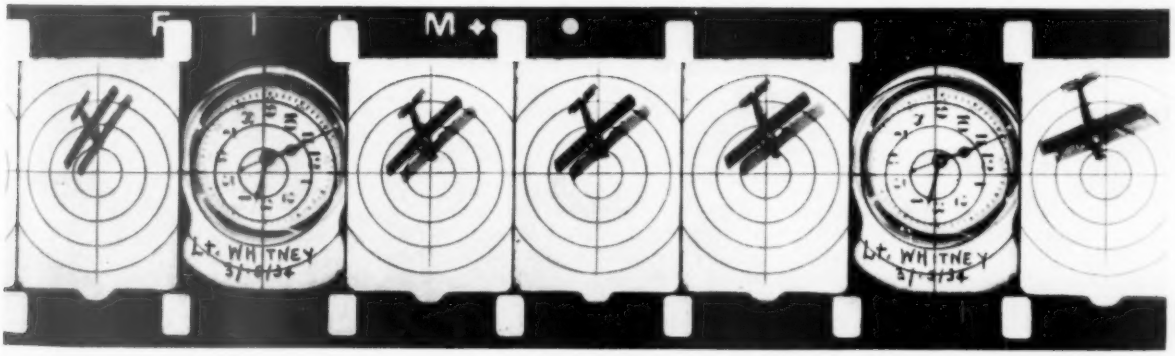
Bore-sights, giving perfect alignment of the bore of the gun, are adjusted at the factory and are slipped into the camera mechanism chamber.

Front view of flexibly mounted camera gun.

By the bore-sight, the gun can be accurately aligned with the axis of an airplane provided with rigid mountings, a vital arrangement with fixed or rigid guns. They are also used to check up the ring and bead sights on flexibly mounted guns.

For displaying the photographs before a class, or a large group of men, a special projector has been designed for throwing the pictures on a screen. This is not a motion picture projector, but one in which the photographs are shown one at a time. It takes 50 feet of film and gives a sharp image with a screen as large as 3x4 feet.

The "viewing device" is a smaller type of projector used for quick and easy scanning of the film. It throws small images 1½x⅞ inches on a ground glass screen so that the scoring officer can judge the hits without having to run the film through a complicated projector.



Typical sections of film showing shots fired by camera gun. A single shot at the left, followed by the watch and data card. Then, a burst of three shots followed by the watch and data card. The reticle consists of the four circles and cross-hairs.

The 1934 Monocoupe Model "D"

The Monocoupe "D" is an unusually clean design arrived at after many years of experience with this type of ship.

THE 1934 Monocoupe "D" is powered with the new 145 horsepower Warner Super-Scarab motor. Although similar in its general appearance to former Monocoupes, many refinements and improvements resulting in better performance and increased comfort have been built into the Model "D."

The ship presents a very neat and trim appearance, a special effort having been made to obtain the maximum performance consistent with the requirements for cabin space and comfort.

The wing is a two-piece construction externally braced and has a special fairing built into it at the strut intersection or connecting points. This fairing also provides a space for the mounting of landing lights in the lower part of the leading-edge so that their resistance is reduced to a minimum. A portion of the leading-edge of the wing, at the root and the entire top of the cabin back to the rear spar is covered with Plastacele, as are the windshield and windows extending back to the rear of the cabin. The vision has been much improved by this construction.

The cabin width has been increased six inches and the seating arrangement and controls are changed so that there is ample room in the cabin. Ventilation is obtained by means of a fresh air duct bringing the air into the cabin from a point forward of the motor and a manually controlled ventilator located at the rear of the cabin roof. The window on the pilot's side of the cabin is hinged at the top so that it may be opened outward.

The instrument board has been increased in size, allowing sufficient room for the installation of blind-flight instruments. The gasoline system consists of two 15 gallon tanks located in each wing and a 4½ gallon reserve-tank just forward of the instrument board. A fuel control valve is located at the bottom and center of the instrument board. The two wing-tanks have sight-gauges located at the top of the cabin on each side while the reserve sight-gauge is located just forward and above the instrument board.

The reserve-tank is filled continuously through the main tanks as long as the main valve and the reserve valves are in the "on" positions, and with the fuel valves in these positions, gasoline may feed from either or both wing tanks and the reserve. The reserve tank then begins to drain as soon as the main tanks are dry. If desired, the reserve can be turned on until it fills, then shut off until needed.

The control system has been designed so that the controllability and maneuverability are obtained with minimum control loads transmitted to the pilot. A metal cowl covering the bottom of the fuselage, which is easily removable, provides for quick inspection.

Longitudinal balance is controlled by means of a movable tab on the elevators which in turn is adjusted by a small lever located on the left side of the cabin. A continuous adjustment is provided having sufficient range to take care of all normal loading conditions. This type of adjustment allows the use of rigid stabilizer construction.

A combination NACA tunnel type cowling is used, so designed that the resulting head temperatures are well below the maximum allowable values. The rapid and easy removal of this cowling for servicing and inspection is made possible by its construction, and the use of Dzus quick acting fasteners.

The landing gear is particularly well streamlined and rather unique in construction, in that it employs a combination oil and shock-cord tension strut located in the fuselage and fastened to the wheel axle by the streamline brace wires. Wheel pants are included as standard equipment. A full swiveling, steerable tail-wheel having a pneumatic

(*Concluded on page* 48)

The Aero-Sportswomen

by JOAN THOMAS

ONCE upon a time, as all good fairy stories begin, someone told us that the hardest part of an Atlantic flight was raising the money to finance it.

The editor of this column can corroborate that statement as applied to most any kind of a flight. We had a grand idea a couple of months ago, for an aerial publicity tour for the 1934 Century of Progress; which (the Fair, if not the flight) will be flaunting itself across the headlines of the country's newspapers—'ere this magazine is off the press.

Major Chester Fordney of stratosphere fame was our first convert; he thought it was "swell." The Chamber of Commerce was our next approach, and they not only approved of the idea but gave us some valuable suggestions and sent us out on the long, long trail of a public-spirited financier, or a wide-awake advertising manager, who might see the handwriting in the skies!

The idea of being a flying "Baby Ruth," or a winged package of "P.K.," didn't appeal too much, but after all one's engine does drink gasoline and oil, and the baby (Waco) needs shoes—at least it wears pants.

However, we won't tire you with a long recital of those letters we wrote (masterpieces in subtle sales-psychology), neither will we tell you our private opinion of the lynx-eyed Private Secretaries, who sit outside the mahogany doors of those inner sanctum sanctorums of Big Business. They demand your life's history before they will deign to present your name within the holy of holies.

Private secretaries are the watch dogs of commerce—as typically American as hot-dog stands and gasoline stations—but they are a pretty good invention at that. Most of them are alert, friendly, suave masters of adroit questions; always diplomatic, but adamant when it comes to appointments. We know one, that we would like to recommend to the League of Nations.

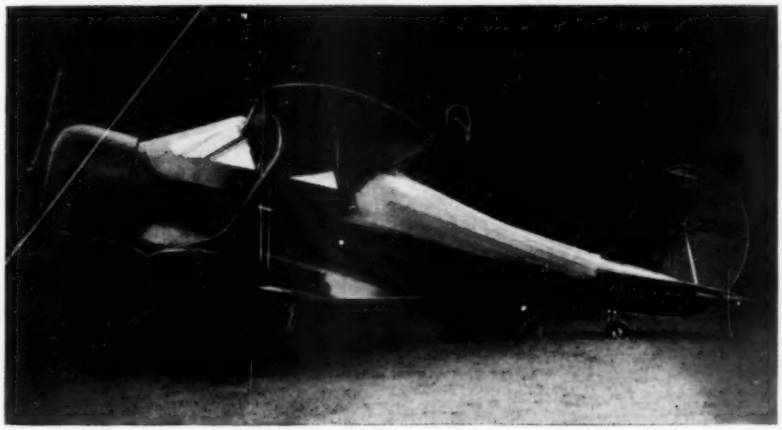
Then the "Keep Chicago Ahead Committee" was organized, and we began sitting on their doorstep. It was great fun planning the Tour—drawing maps and charts, measuring distances and figuring flying time; estimating costs, deciding where to stay over night (and being a born-vagabond, there were a lot of points we found quite necessary to visit!). We could have spent all summer publicizing the Fair and not seen nearly enough. However, controlling our insatiable curiosity, we organized an itinerary that would cover as much territory as possible in the allotted time.

Thousands of plans have been offered to the Committee, as someone said, if they had had two million dollars to spend they could have easily used it all. But whether our pet "brain child" is among those fortunate enough

(*Concluded on page* 57)

The 1934 Beechcraft is Speedy

THE new Beechcraft has shown a remarkable performance for a cabin plane having only a 225 h.p. powerplant. It is designed by the veteran designer, Walter Beech, who founded the Travel Air Company years ago.



THE new 225 horsepower model B-17-L Beechcraft is built for the convenience of the busy executive and others who want a dependable plane for private transportation. It is powered with a Jacobs engine and has many features that enhance its superior streamlining. This gives a minimum of resistance to the air and explains its greater speed and economy.

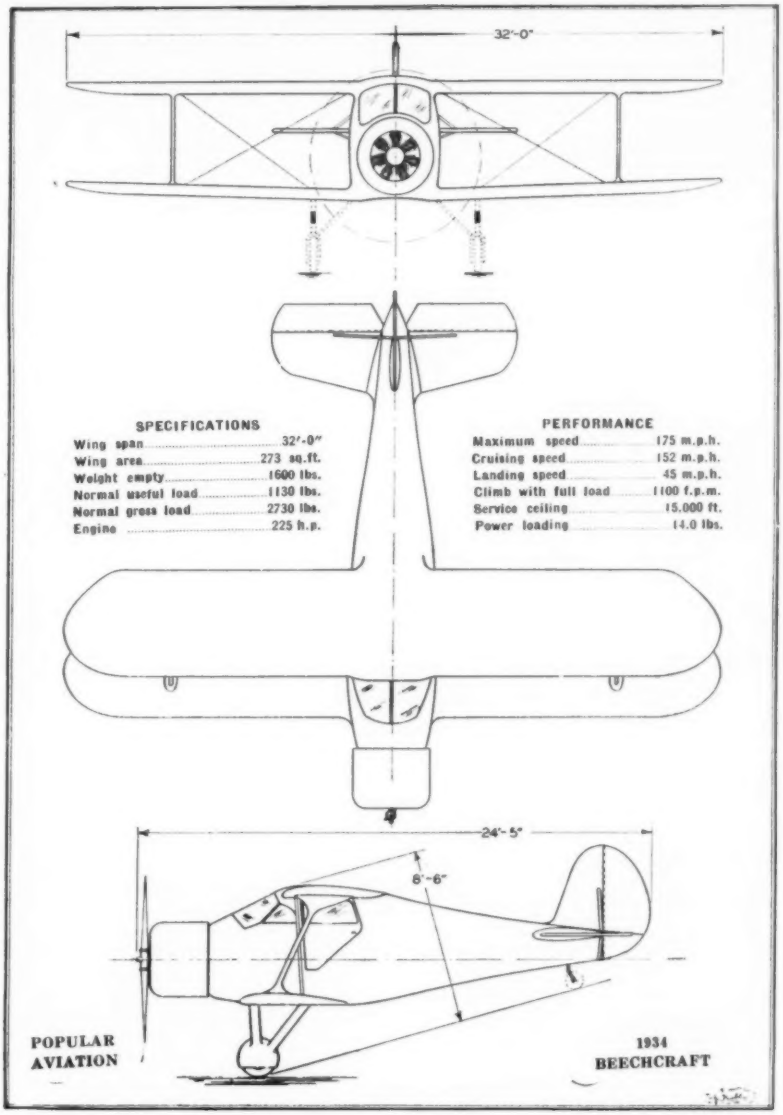
It has a top speed of 175 miles per hour, a cruising speed of 152 miles per hour and a landing speed of 45 miles per hour, all guaranteed to be within two percent of these figures. With a licensed useful load ample for four or five persons, adequate baggage, full gasoline tanks and any additional flying equipment that may be desired, it has a speed that is at least thirty miles faster per hour than any other standard four-place cabin airplane with the same power rating. This places the operating cost on a footing with the automobile and gives this plane a high overall economy that appeals to the private owner.

In spite of the fact that this plane is fast, it has a slow landing speed. This is due to the drag produced by the decelerators built into the under side of each lower wing and the additional drag produced when the retractable landing gear is lowered into position. The decelerators, or wing flaps, are opened at the same time that the landing gear is lowered for landing. This makes for a safe landing even in small fields.

Some of the factors contributing to the low head resistance is the retractable landing gear which by folding smoothly into the fuselage, gives a perfect streamline form to the under part of the plane. The windshield is made of safety-glass and molded so that it has no sharp corners. The wings have negative stagger.

The landing gear is of a simple, foolproof design developed by the Beech engineers, working automatically and so swiftly that almost the instant the pilot is off the ground the landing gear is in the space provided for it and this space is shut and locked. The gear is fully retractable and oversight in lowering it is prevented by making it impossible to close the throttle without releasing the landing gear latches.

The gear has 24-inch streamlined wheels and a 10x3 inch tail wheel. Shock is taken up by hydraulic shock absorbers on the landing gear and com-



pressed rubber for the tail wheel. The framework of the fuselage is steel tubing, welded and covered with fabric and aluminum.

The upper wings are placed to the rear of the lower set, giving the pilot ample vision at all angles of flight. He can see up, down, forward and to both sides. This feature was developed by the Beech engineers and has been in use on the model 17-R 420 horsepower Beechcraft for two years. The windshield has also been in use for two years on the older model and was also developed by the Beech engineers. The windshield on both planes is made complete in two sections.

While the cabin arangement is very compact, comfort and beauty are features of the design. The seats are wide with plenty of elbow and leg room. Forward seats are on slides and may be moved back out of the way when the front seats are entered. They are richly upholstered and all fixtures are beautifully finished. Either warm or cool air is easily supplied when desired while the soundproofing of the cabin makes conversation pleasant and easy.

All controls are easily accessible so that the pilot does not have to make unnecessary movements while he is busy flying the ship. The throttle, mixture, gear control and stabilizer are located in the center of the dash where they are easily reached. And to operate the fixed stabilizer adjustment the pilot simply moves a knob located close to the throttle.

All necessary standard instruments, the compass, altimeter, ammeter, tachometer, air speed indicator, oil temperature indicator, oil pressure gauge and gasoline gauges and also all standard accessories, the starter, generator, navigation lights, and a storage battery are carried in this ship.

Altogether, this latest development of the new Beechcraft is an ideal airplane for private transportation. It is now being manufactured in the factory of the Travel Air Company in Wichita which Mr. Beech has leased from the Curtiss-Wright Corporation. Mr. Beech organized and developed the Travel Air plant and sold it to Curtiss-Wright several years ago.

Beechcraft Specifications

Wing span	32'-0"
Wing area	273 sq. ft.
Overall length	24'-5"
Height	8'-6"

Weights—Loading

Weight, empty	1,600 lbs.
Normal useful load	1,130 lbs.
Normal gross load	2,730 lbs.
Maximum gross load	3,150 lbs.
Weight per horsepower	14.0 lbs.
Wing loading, lbs., sq. ft.	11.5 lbs.

Performance

Maximum speed	175 m.p.h.
Cruising speed	152 m.p.h.
Landing speed	45 m.p.h.
Climb with full load	1,100 ft. min.
Service ceiling	15,000 ft.

END.

Eugene Clay Completes His Trip

Gene is riveting. Wonder who's bucking up?

EUGENE CLAY, winner of the second prize in the P. A. Model Contest, took a trip to the Boeing plant, Seattle, Wash., as his award and thoroughly enjoyed himself.

He is shown above trying his hand at riveting a regular transport plane under the direction of C. L. Egtvedt (left), president and general manager of the Boeing plant. We'll bet that Gene went home crammed with new ideas and that this experience will be reflected in his next models.

Strange Forced Landings

IT was in one of those strange events, difficult to explain, when four Navy planes ran out of gas simultaneously and were forced down at sea north of San Diego. At that time it was given to one of the crew to prove himself a hero.

Ensign Victor H. Soucek volunteered to swim ashore to secure aid. The coast was an undetermined distance away because of a fog that covered land and sea. Peeling off his heavy flying garments, he dived into the water and struck out for shore. Shouts of approval from his comrades urged him onward.

Although a strong swimmer, Soucek neared shore almost exhausted. He kept on and finally staggered to the beach where he notified authorities of the accident at sea. In a short time nearby Navy vessels reached the drifting planes and hauled them and their occupants aboard ship.

Two of the planes were attached to the U. S. S. Maryland, one to the West Virginia and one to the Tennessee.

The strangest thing in this incident was not the swim to shore, though that was heroic, but the fact that all four planes ran out of gas at the same time and were forced down within a short distance of each other.

Repairing a Broken Rocker Arm

A SHORT time ago, two prospectors flying a small plane in Northern British Columbia had the misfortune to break a rocker arm on their engine. They were more than three hundred miles from a repair station and they could not hope for a new rocker arm for that particular engine, even if they were at their own field.

Luckily, the broken part did not fall off—it was really a crack that had almost severed the arm—so they landed at once as it was impossible to carry on in that high altitude without a full powered motor. Ruefully they looked at the broken member and suddenly one of the men was smitten with an idea.

Taking the broken arm off, he polished the ends across the break and told his companion to unship the gasoline camp stove. This was done and during that time the enterprising mechanic filed a spare brass turnbuckle until he had an appreciable amount of brass spelter. The stove was lighted and the toasting plate placed over the flame.

This plate is merely a piece of tin and in a minute or two it was red hot. The broken rocker arm was placed on the tin and shoved over the fire. Five minutes later the arm was red and the amateur welder was sprinkling borax —obtained from the small medical kit— over the ends of the break. He then carefully sprinkled the brass filings on the crack where they immediately melted and formed a strong braze.

The fire was then turned down and more brass added until the break was well covered and built up. It was then allowed to cool.

The arm was filed and fitted to the engine again and a short time later the plane was headed back to its base. The impromptu repair held until a new arm was secured and, although the faces were softened a trifle, it is probable that the makeshift would have lasted almost as long as the other rocker arms.

Will Rogers' Turkey

THIS story may not be seasonal, but it's good enough to bear repeating, anyway. At Christmas time, Richard W. Robbins, president of Transcontinental and Western Air, sent a few holiday turkeys from his brother's farm in Kansas to friends. One went by airplane to Will Rogers in California. The next day Rogers wired Robbins:

"A Kansas turkey flew in here yesterday against a head-wind, made a two-point landing, had nothing but his wings and fuselage, said he came over the TWA route and refueled at Wichita, Amarillo, Albuquerque and Winslow, and he must have, for his tanks sure looked full. He is a good flyer, but I look for him to crack up about Xmas day and, like all good Kansas tourists, he is not going back. Thanks for starting him on his way. I will send you an orange some time."

The Inside Story of the "Bullet"

by J. D. VAN VLIET

One of the most remarkable of the early post-war planes was the Christmas "Bullet," a flexible cantilevered sesquiplane that incorporated many novel features. It was the forerunner of the modern cantilever monoplane.

OLD timers may remember, that shortly after the Armistice in 1918, there appeared on U. S. Governmental Field No. 1, Long Island, a small one-seater airplane which in many of its features differed radically from the designs then in vogue.

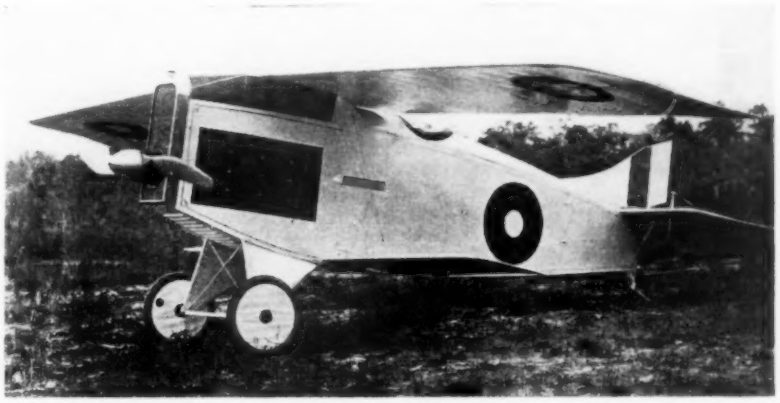
This craft, soon to be internationally known under the name of "Christmas Bullet", possessed a short deep fuselage of singularly clean lines. A pair of upper wings, set at a cathedral angle, extended from the upper surface of the fuselage. They were supplemented by a pair of lower wings, set at a dihedral angle, carried flush with the bottom of the fuselage, the lower wings being of half the span and half the chord of the upper wings.

The gap was sufficient to obviate any aerodynamic interference of one set of wings with the other.

The upper wings were capable of flexing up laterally so that they would assume a dihedral angle in flight, which then made them practically paralled to the lower rigid wings.

The wing profile was quite unlike any of those used on existing airplanes. It had a double cambered portion extending back about two-thirds of the wing chord at which point it merged sharply into a flat and thin trailing portion of great resilience and capable of yielding to airpressure. The profile of the wings was, in fact, a mechanical reproduction of a bird's wing, while the lateral and helicoidal flexing of the wings closely simulated the action of the wings of a soaring bird.

Dr. William Whitney Christmas, the inventor of the Christmas "Bullet."



The Christmas "Bullet" is a neat trim looking little ship that showed a speed of 190 m.p.h. 'way back in 1918. Note the self-supporting cantilever wings.

An outstanding feature was the complete absence of all external wing bracing, neither struts nor wires marring the pleasing sweep of the true cantilever wings and the harmonious lines of the body.

The tail surfaces were comparatively small and were also provided with a resilient trailing edge so that altitude control was effected by warping the trailing edge of the horizontal tailplane. The upper wings carried small ailerons which proved to be superfluous in level flight and were mainly used when making turns. The landing gear was of simple construction and devoid of shock-absorbers. The deep front part of the fuselage housed a six-cylinder 175 h.p. engine turning 1400 r.p.m. It was capable of a maximum power output of 185 h.p. and was cooled by a front radiator.

Taking it all in all, the Christmas Bullet was as trim and speedy-looking a craft as ever graced a flying field. It was the first true cantilever airplane ever built, as well as the first sesquiplane, the first strutless biplane and the first flexible-winged airplane.

Needless to say, the many radical innovations which it embodied were regarded with mingled feelings ranging from admiration to downright animosity and the opinions offered by the beholders were many and varied.

The somewhat malicious predictions as to the ship's inability to fly at all were agreeably refuted at the first trial flight, which took place on December 3, 1918, the pilot being Cuthbert Mills, an experienced mail flyer and war-time instructor.

To the surprise, and possibly the annoyance, of many of the spectators, the Christmas Bullet took off after a very short run and showed a speed of 190 m.p.h. this figure being subsequently confirmed by the late Col. Thurston S. Bane who was one of the Army witnesses. Although the weather was unfavorable and stormy, so that several army planes, deemed it advisable to come down, the Bullet stayed up and it became at once evident that this machine possessed inherent lateral stability as well as a climbing ability seemingly out of proportion to the power available.

Unaffected by the turbulent air conditions the Christmas Bullet continued to speed along, turn, bank and climb as in the fairest weather, until the pilot finally set her down at a landing speed of about 55 m.p.h.

The machine came to a stop after a very short roll, and the pilot reported that no difficulty whatever was experienced in turning and steering—the plane was practically flying itself.

The first flight was thus an unqualified success and the marvellous performance put up by the Christmas Bullet attracted wide attention, especially so in France and Germany in which countries the possibilities of the flexible wing were considered sufficiently well demonstrated to warrant a careful investigation of the subject. The same could not be said for this country.

Four more extended flights followed, all equally successful. Maximum speed was achieved at about three-quarter throttle, and climbing was effected by simply letting out on the throttle; the Bullet would then rise on an even keel.

After the fifth flight, the Bullet was taken back to the factory and the wings were stripped and inspected in order to determine the effect of the flexing and twisting of the wing. The main longi-

tudinal members comprised spars of laminated spruce reinforced by overlapping strips of steel, the spars being interconnected on top and bottom by plywood and thus forming a box-girder of considerable width which constituted the backbone of the wing. This construction, originated by Dr. Christmas has since been adopted with slight modifications on several modern airplanes.

Dr. Christmas never contended that the details of the construction, as exemplified in the wings of the Bullet, were to be regarded as final. His suggestions in this respect were invariably directed towards improvements and refinements; but he did claim and supported his claims by successful demonstration, that the salient features of his design were mechanically adequate to the construction of cantilever wings and in harmony with the principles underlying the anatomy of the wings of a soaring bird.

Considering that, in those days, designers were mainly occupied with the development of rigidly trussed wings, or with externally braced rigid wings, and that the mechanics of flexible wings or flexible spars had never been deemed worthy of serious consideration, it is not surprising that Doctor Christmas was laboring against a current of prejudice and derision.

Since no defects in the steel reinforcements nor in the spars were discernible, it was decided to determine the effect of increased flexibility by using inner steel strips of a higher modulus of rupture and omitting the outer strips. The pilot received explicit instructions to take off from a small clearing back of the factory and to describe a large circle of about half a mile in diameter which should have brought him back to the starting point in less than a minute.

The Bullet, equipped with the new wing, got off quicker than before and showed even greater speed. But instead of making the easy turn, as instructed, the pilot headed the plane due West, skimming over the tree tops with a foot to spare as was his wont and was soon out of sight.

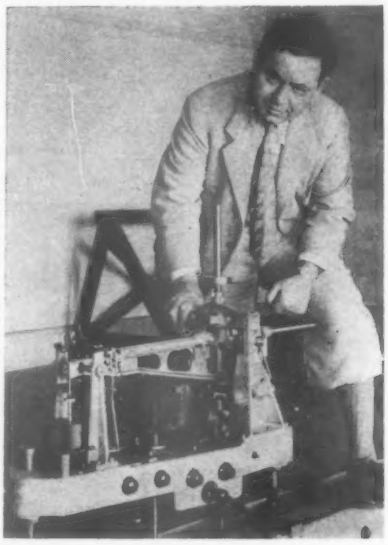
Realizing that the instructions were being disregarded and that no observation would be possible, automobiles carrying Dr. Christmas and his associates dashed after the plane at breakneck speed down the Merrick Road, a distance of fourteen miles. The Bullet, however, was nowhere in sight and a farmer reported hearing a crash soon after the plane skimmed over his house.

A search revealed that the plane and its pilot had come to grief about half a mile north of that point. He had flown, apparently, at full speed, into a tree at the end of a small clearing. It was plain that the pilot had executed an exceedingly sharp turn when changing his direction from due West to due North.

As there were no eye-witnesses to the crash, the real cause was a matter of conjecture. The plane was telescoped

(*Continued on page* 50)

Scales for Wind Tunnel



The Scale-Set.

MR. ARTHUR L. KLEIN, of the California Institute of Technology's Guffenheim School of Aeronautics, has invented a new wind-tunnel balance, something like a grocer's scale, except that it is much more accurate and weighs several forces at one time.

It was designed to accurately measure the various forces acting on an airplane in a wind tunnel. Located on the floor above the tunnel, it measures the loads accurately to one-fourth of a gram.

K-K-Choo!

THE beneficial effects of airplane riding on the "common cold" often have been attested to by pilots and now comes a physician who agrees there probably is something to these claims. He is Dr. Haldor Carlsen of Chicago, who has conducted a series of tests along this line.

"Pilots, stewardesses and other persons who have much to do with airplanes," says Dr. Carlsen, "always have believed that a high flight would cure a cold. We have made some further observations among passengers and we have found some 50 of them who have left Chicago with colds in various stages, from the 'sniffles' on, arrived at Newark, N. J., airport with their colds entirely gone."

Navy Plane in Mercy Flight

THE wife of one of the keepers of the lighthouse on the lonely rock, 65 miles west of San Pedro was very ill. A distress call was sent by the Coast Guard and two Corsair seaplanes from the United States Fleet flew a surgeon from the ship and his equipment from San Pedro to Anacapa Island to aid the sick woman. They were back aboard the battleship three hours later.

Warning to Collection Fiends

FROM the War Department at Washington, there recently came a warning which may be of value to you collecting fiends who are interested in World War souvenirs. It seems that in France, shortly after the war, thousands of people invaded the battlefields in search of souvenirs. Many were found, and taken home to grace the family piano or mantel shelf. So far so good!

But of recent years, the French police have been disturbed by an increasing number of mysterious explosions in which several people have been killed or injured. No explanations were found for the explosions until the police, checking backward, learned that in these homes where the disasters had occurred, World War souvenirs had been on display in some conspicuous place.

Tests made of other souvenirs disclosed the fact that such things as hand and rifle grenades, small shells and percussion caps, etc., were becoming very dangerous. Many of these pieces, still loaded, were being affected by rust working on the safety devices and rendering them useless. Without the safeties—a little concussion or a fall to the floor, and—BOOM!

So the French police are now at work confiscating such pieces of ammunition as are thought to be dangerous, and information concerning the work was passed on to Washington. Through official publications, the authorities at Washington have advised owners to get rid of all souvenirs that are or may be explosive. Handle them very carefully, and remember that the bottom of the deepest lake in the vicinity is the best place for them. A few tears, maybe, will be shed—but better that than a life.

A Long Shipment by Air Express

THE shipment in question was not so long in point of mileage as it was in point of inches, although it traveled from Los Angeles to Boston.

When Bill Graber, world's champion pole vaulter, was to appear in the indoor meet at Boston and participate in the pole vaulting entries, he used the Transcontinental & Western Air as a means of transportation. He was in a hurry to cross the continent so as to not be away from his studies at the University of Southern California any longer than necessary.

Bill is a conscientious student, you see. But there was the 18-foot vaulting pole which had to go along with Bill. Never before had the TWA plane been called upon to carry such a long package. Could it be done? Sure it could, by shoving the pole way back into the tail of the plane there would be room enough to accommodate its length.

And so Bill and his famous vaulting pole traveled across the continent in the tri-motor TWA plane.

Landing at High Altitudes

by "WYOMING"

Here, the author discusses the difficulty of making landings and take-offs in the Rocky Mountain country where the thin air of the high altitudes introduces many hazards for the stranger.

WYOMING is all one big A1A airport. A place where a forced landing would be a pleasure rather than an unpleasant experience and I wish to pass on to you my own experiences, as well as the advice of many old timers who cross the state every day.

Let's take the country around Cheyenne for an example. There are several points to consider. I will name as many of them as I can recall and then take them up in detail.

1. The altitude of the airport is about 6250 feet.

2. There are frequent high velocity winds.

3. The ground as seen from the air seems flat and is of a uniform color.

Now we will take each point and enlarge upon it. Since the airport is at a high altitude, the air is not as dense as it is at sea-level. As a result, the take-off must be long and the climbs are shallow. On the other hand, the glide must be steep—almost a dive. In other words you have to set them down "hot."

The high velocity winds are such that, during some months of the year, there are only two or three days suitable for flying lightplanes and then for only an hour or so. Take it from one who has lived and suffered at the hands of such winds. You feel as if you were riding a washtub in a mill race. It is not a very pleasant experience. Of course, if you are flying an airplane with lots of soup under the bonnet—all right.

These winds are strong and gusty, and what is worse—shifty. It is nothing to have a wind shift sixty or seventy degrees at the moment you are getting ready to set her down. On one occasion, I looked down and the smoke from a factory was drifting past, the wind sock pointing West and the "T" pointing Northeast. Take your choice.

The ground looks flat. I said it *looks* flat. Having covered it on foot I can truthfully say it isn't. There are all kinds of funny little humps and ridges and whatnots. But I must, in all fairness say that there is usually a good landing point within gliding distance of wherever you might be flying excepting, of course, the mountains. But to return to those funny little humps and ridges. They do the strangest things to the winds. An up draft here, a down draft there and in between them is a bewildering assortment of all kinds of drafts. This is near the ground and is what makes landings and take-offs tricky business with light airplanes.

What about this uniform color of the ground? Ask any pilot who has flown a seaplane and he will tell you in no uncertain terms. Your judgment of altitude just ain't unless there are some marks or features to guide you such as houses, stream-beds, roads or hills. The ground looks the same at five hundred feet as it does at five thousand. 'Nuff sed.'

High above the cumulus clouds where "hot" landings are assured.

And now, what are you going to do about all of this? Here are a few hints that might help. First of all, flying speed is even more essential than it is at sea-level. You can stall easier and spin longer up there than you ever dreamed. It is a good idea, therefore, to even drop your nose a little on the turns when flying low. Make your climbs shallow and your glides steeper than you would normally want to. You are going to need that speed to take care of those funny little ground eddies should they occur. They usually do.

Watch Your Gliding Turns! It is awfully easy to stall and spin in if you don't make them steep. At the same time, let me assure you, that those hot shot slips to kill speed in landing are *out*. Quite a few really good pilots have lost a wing or two through being unable to recover in time. Use narrow "S's" instead.

Don't fight the air. By that I mean, don't try to make a steep climb out of a down draft, for an instance. Hold what you have and ride it out. I have gone several miles across country with the motor wide open not fifty feet off the ground making gentle turns to avoid obstacles.

At that, I was better off than the unfortunate stranger who took off at the same time in a heavier airplane and squashed it down on a nearby hill in a futile attempt to climb out of the down draft. The same applies to forms of air disturbances. You can't beat that "P equals AV^2," or whatever it is that means that the air is stronger than you or your airplane.

There is a gentleman at the airport at Cheyenne who can do things with a lightplane that never were in the book. I nominate this gentleman, Harold T. Bean is his name, as the logical successor to the late and beloved Ed Heath as the dean of lightplane pilots. He knows every inch of that territory and every cubic inch of air over it. If you are ever up in that country and are in doubt as to whether you should fly at the moment—ask him. If he says "NO," well, then you had better borrow a horse and play cowboy till the weather changes. Mr. Bean does beautiful repair work on airplanes belonging to pilots who do not take his advice.

In closing I want to assure you that I am not trying to scare the novice pilot away from them thar hills but am trying to show that he must respect the conditions as they are. As a matter of fact it would be a good idea to take a crack at it. Many old timers who fly the mail across that country say that there is no finer flight training than flying a lightplane around and about a high altitude airport.

Why Our Naval Aviation

by
E. STANTON BROWN

Specialist in aeronautic statistical data and industrial relations.

The Curtiss "Goshawk," F11C-2, a late acquisition of the U. S. Navy which is miles slower than similar ships owned by other great powers.

AFTER our Army Air Corps so wretchedly and tragically failed to meet the Air Mail emergency and after subsequent investigation had revealed that, in its present miserable condition, the Air Corps was utterly ineffective as a means of defense, one naturally turned an inquiring and skeptical eye toward the Naval Air Service.

If, under our present national policy toward military aviation, our swiftest and best army fighters ranked sixth among the fighting planes of the world and were unable even to reach similar foreign aircraft to engage them in battle, how did our Naval Air Service rank in this respect? Would the Navy be capable of filling the gap?

If the Air Corps was merely a football to be kicked about by politics and the other branches of the Regular Army, if it stood as Exhibit "A", attesting to Congressional stupidity, was there any reason for believing that the Naval Air Service fared any better?

If the taxpayer's millions had been sunk in an Army Air Corps whose equipment, in comparison with that of half-a-dozen other nations, is good for nothing but junk or training purposes, have similar millions of the taxpayer's hard-earned dollars been squandered on our Naval Air Service?

It is your right and my right to know the answers to these and similar questions. The millions of dollars of the people's money spent on these services are our insurance premiums for national security. If these services are not equal to, or better than, the finest of military air forces in the world, and if they do not fulfill to the highest degree their known purposes and abilities in a rational plan of national defense, then we have been cheated outrageously; cheated not only of our money but, still more important, of our right to adequate protection for our homes, our families, our livelihoods, our national safety!

We have already seen from the June issue that our Army Air Corps, in its present condition, can offer us no assurance, whatsoever, of security. Let us see if our Naval Air Service, part of our first line of defense, can offer us that assurance of security.

Look at the photograph of the aircraft carriers "Lexington" and "Saratoga," anchored off Waikiki Beach, Honolulu. They look quite formidable, don't they, with their great size and the fighting planes clustered on their decks? But actually they are of but little practical use—junk, if you will!

The best of the fighting planes on those decks are miles slower and have ceilings thousands of feet below the best fighting planes of Japan. If you will refer to the tables in last month's issue and compare them with Table I in this issue, you will find that even the army fighters stationed ashore cannot compete with Japan's naval warplanes at war-service altitudes, and that the best of our army fighters have ceilings 3,000 feet below Japan's Navy fighters.

Look at Table I. Our single-place and multiplace fighters, and our observation planes are hopelessly outclassed by Great Britain and Japan in speed, rate-of-climb and war-service ceilings. Great Britain, France and Japan outclass us in Torpedo-Bombers. Great Britain, Italy, Holland, Japan and France outclass our Navy Patrol Flying Boats.

Great Britain and Japan have adopted and developed the tail gun for their large military aircraft, which gives those planes a 50 percent. advantage over planes without them. Tail guns are unknown on our planes.

In examining these tables always keep in mind that it is the performance at war-service altitudes, not the speed at the insignificant altitude of five or six thousand feet, that counts. The plane that can climb the fastest and go the highest has an insurmountable advantage over other planes. And let me remind you once more that these tables have been checked by our own government experts and declared accurate.

It is a smudge on the engineering ability of America, the birthplace of the airplane, that our military planes should be so outclassed by those of foreign nations. It means that we are from three to four years behind them in military aeronautical development and that we have a tremendous handicap to overcome. If we are to catch up, we must not only come up to present standards but we must match the continued development of other countries.

For those of you who would scoff and maintain that there is no possibility of our becoming embroiled with those nations which outclass us, either because of our supposed isolation or because of friendly relations, let me remind you that our isolation is becoming a more ridiculous myth every year. Don't forget that we fought England in the American Revolution and again in 1812, for the unity and independence of our country. Then we turned around and blasted hell out of our own countrymen in the Civil War. In the World War, united again, we fought shoulder to shoulder with Great Britain against an enemy which England had hired to fight against us in the Revolution. In this unstable, topsy-turvy world *anything can happen.* Because of that, and because of the wave of unrest that is now sweeping the world, our only assurance of safety is to be on a par with, or better than, the best nation in the world.

With this in mind, review the tables printed last month and turn your attention to Tables II and III in this issue; tables of battle comparisons of the leading naval warplanes of the world.

Let us suppose (Table II) that our Naval Air Service was commissioned to

Is Alarmingly Deficient

IN this sequel to Mr. Brown's article in the June issue, treating of the U. S. Army Air Corps planes and their defects, the author discusses the status of our navy planes.

This article is worthwhile not only from the standpoint of a discussion of conditions, but also for the tabulated performance data given.

operate against an attacking fleet with its air-force and that our naval warplanes were attacked by the foreign single-place and multiplace fighters.

At war-service altitudes particularly, our single-place and multiplace fighters would be hopelessly outclassed in the matter of speed and rate of climb. They would have no chance against the superior foreign fighters. Our observation planes, torpedo-bombers (Table I) and patrol flying boats, needing the protection of the pursuit planes, would not be able to operate.

The fighters on the Macon would be unable to defend her. If she went higher than 21,700 feet her defending planes could not return to her nor defend her, while she would be still a target for the foreign fighters up to and beyond her ceiling of 30,000 feet.

If, on the other hand, the foreign navy warplanes came to us and it was up to our single-place and multiplace fighters to see that they didn't do any damage, the result would be tragically comical. Table III shows that we could not touch them in any way. If the foreign planes did not care about fighting at the moment, but had some other dirty work to do a bit farther on, they could merrily thumb their noses at us while they disappeared in the distance or sat safely up out of reach.

The foreign Navy fighters could adequately protect their torpedo-bombers. The best of the foreign observation planes could serenely conduct their work uninterrupted, since they are as fast, or faster, than our fastest fighting planes and have ceiling from 2,500 to 4,500 feet higher than our best Navy pursuit ships. The foreign patrol flying boats could meander around patrolling to their heart's content, needing little or no protection because of their tail guns.

Table IV still further indicates our position. Our best naval planes are from 25 m.p.h. to 35 m.p.h. slower than the best of similar foreign planes. Our position with respect to other nations ranges from third to fifth among the various types of naval warplanes.

While the equipment of our Naval Air Service is most certainly nothing to be proud of, and is a direct menace to our national safety, its deficiency compared with the naval planes of other powers is not as great as the deficiency of our Army Air Corps com-

TABLE I

COMPARATIVE PERFORMANCES OF NAVAL WARPLANES

GROUP A: SINGLE-PLACE NAVY FIGHTERS

Country	Type of Warplane	Max. Speed m.p.h.	Max. Speed at ft.	Speed at 10,000 ft.	Speed at 15,000 ft.	Speed at 20,000 ft.	Climb to 15,000 ft.—Min.	War-Service ceiling
Great Britain	Hawker "Nimrod"	210	13,000	210	210	210	8	35,000
	Hawker "Hoopoe"	205	10,000	205	205	200	9	33,000
	Fairey "Firefly III"	210	10,000	210	205	200	8	33,000
Japan	Hawker "Nimrod"	205	13,000	205	205	205	8	33,000
	Nakajima 90	205	10,000	205	200	195	7	33,000
U. S. A.	Boeing F4B-4	190	6,000	190	185	175	9	27,500
	Curtiss "Goshawk" F11C-2	193	5,000	187	180	175	11	25,400
	Curtiss "Sparrow-hawk" F9C-2	175	5,000	171	163	155	13	21,700
	Berliner-Joyce XFJ-2	193	6,000	190	180	170	11	24,700

GROUP B: MULTIPLACE NAVY FIGHTERS

Great Britain	Hawker "Osprey"	205	13,000	205	200	195	8	33,000
Japan	Licensed to build Hawker, Junkers and Dornier planes							
U. S. A.	Vought V-70	174	6,000	165	160	150	10	22,300
	Curtiss "Helldiver" F8C-7	165	10,000	165	160	150	11	22,000

GROUP C: NAVY OBSERVATION, LAND PLANES—CARRIER PLANES

Great Britain	Hawker "Osprey"	200	13,000	200	195	190	8	32,000
	Short "Gurnard"	192	11,000	190	185	180	9	30,000
	Fairey IIIF	175	10,000	175	165	160	10	30,000
Japan	Licensed to build Hawker, Short, Junkers and Dornier							
U. S. A.	Vought V-50	190	6,000	170	160	150	11	25,000
	Vought SU-1	180	6,000	170	165	160	11	25,000
	Vought "Corsair" O3-4	167	6,000	160	155	150	10	23,000
	Berliner-Joyce OJ-25	160	6,000	155	150	145	12	20,000

GROUP D: NAVY TORPEDO-BOMBERS, LAND PLANES—CARRIER PLANES

Country	Type of Warplane	Weight loaded, lbs.	Torpedo or bomb load, lbs.	Power loading lbs./h.p.	Range in mi.	Max. Speed m.p.h.	Max. Speed at ft.	Speed m.p.h.	War-Service ceiling
Great Britain	Blackburn "Ripon" M.1/30.	7,400	2,150	8.7	600	150	10,000	150	18,000
	Hawker "Horsley"	9,650	2,150	12.1	600	145	10,000	145	16,000
	Vickers M.1/30.	8,500	2,150	10.0	600	145	10,000	145	19,000
France	Latecoere 29	6,100	1,540	9.4	500	143	5,000	140	15,000
Japan	Navy 89	7,500	2,000	11.5	800	140	5,000	135	15,000
U. S. A.	Martin BM-2 (125)	6,140	1,000	10.7	450	143	6,000	125	16,500
	Douglas P2D-1	12,700	2,000	11.0	800	125	6,000	115	12,000
	Great Lakes TG-2	8,340	2,000	14.7	800	125	6,000	115	12,000

GROUP E: NAVY PATROL FLYING BOATS

Country	Type of Warplane	Weight loaded, lbs.	Power loading lbs./h.p.	Tail guns	Max. Speed m.p.h.	Max. Speed at ft.	Speed m.p.h.	War-Service ceiling
Great Britain	Short "Singapore II"	27,750	11.6	1	155	6,000	150	16,000
	Short "Rochester"	74,000	14.5	1	150	6,000	145	15,000
	Supermarine "Southampton X"	23,000	15.3	1	130	6,000	125	15,000
	Blackburn "Iris V"	31,500	12.4	1	130	6,000	120	15,000
	Blackburn "Sydney"	22,730	12.6	1	127	6,000	120	15,000
	Saunders-Roe "Severn"	22,150	14.8	1	124	6,000	120	15,000
Italy	Savoia-Marchetti S-55	16,940	12.1	0	147	5,000	135	13,776
Holland	Dornier "Wal"	14,100	11.8	1	143	5,000	135	12,000
Japan	Navy 90-1 (Navy Yard)	26,880	12.8	1	142	6,000	130	15,000
	Navy 90-2 (Kawanishi)	40,000	15.7	1	130	6,000	125	15,000
	Navy 15	15,000	16.7	0	128	6,000	125	15,000
France	C. A. M. S. 55-3	15,180	12.6	0	130	6,000	125	12,130
U. S. A.	Amiot 110	9,094	13.9	0	132	6,000	125	16,400
	Martin XP2M-1 (121)	23,150	13.4	0	140	5,000	120	14,600
	Martin XP3M-1 (120)	15,600	14.4	0	115	5,000	100	12,500
	Consolidated P2Y-1	20,000	11.6	0	120	5,000	100	14,000
	Hall	40,000	15.4	0	140	5,000	120	14,000
	Keystone PK-1	16,303	15.5	0	120	5,000	100	12,000

pared with the army warplanes of other countries. Our naval planes show an average deficiency of 32 m.p.h., or 17.86 percent., while our Air Corps planes show an average deficiency of 50 m.p.h., or 23.67 percent. as compared to other nations.

On probing behind the scenes in an attempt to place a finger on the causes of the prostration of our aerial defense, one is most certain that very few of them lie within the services themselves. One cannot help but be struck by the fine caliber of the men who go to make up our Naval Air Service and our Army Air Corps; their acuteness, their sincerity and devotion to their services, their keen perception of their needs and their courage and willingness to undertake any mission.

There are no finer officers or men in the military services of the world than are found in the two branches of our military air forces. They do the best they can, and that best is sometimes amazing, as they struggle under the handicaps imposed upon them by a Congress that neither knows nor understands their needs and the tremendous military power they control.

There is one outstanding fact that cannot be ignored and that is that Congress controls the purse strings and that in the last analysis our air services are as good as Congress makes them. The manner in which Congress handles this important detail is only too clearly shown in the late Admiral Moffett's "Report of the Chief of the Bureau of Aeronautics to the Secretary of the Navy—Fiscal Year 1932.

"For the fiscal year 1933, a reduction of $7,084,580 has been made by Congress in the total funds available under the appropriation Aviation, Navy, as compared with the amount available for 1932 . . . . . the most drastic economies in every direction will be necessary during this year in order to avoid serious injury to Naval Aviation."

Admiral Moffett then went on to say that under directions from the Secretary of the Navy to cut naval aviation expenses below even the amount appropriated, that "savings of $3,541,103 were made in the Navy for the fiscal year 1932. This represents 11.4 percent. of the appropriation for that year.

The saving was made possible by:

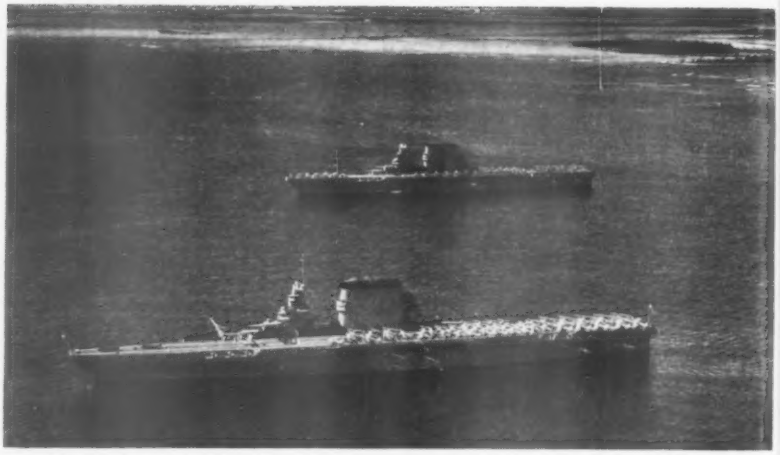
(a) Successive reductions in the operating force of the Navy.

(b) The abnormally low price of aviation gasoline and oil.

(c) The reduction of spare engines from 100% to 70%; and finally from 70% to 50%."

Once more the strangle-hold had gripped one of our military aviation services with the result that its operation and equipment were cut down. It seems that there are those in high command in the Navy who delight in wrapping seaweed about Naval Aviation and limiting its operations to the

(*Continued on page* 46)



The U. S. N. aircraft carriers "Lexington" and 'Saratoga" with their decks covered with airplanes, anchored off Waikiki Beach, Honolulu. These carriers and their planes would be virtually helpless in a raid by any one of the major nations.

TABLE II

BATTLE COMPARISON OF LEADING FOREIGN NAVY PLANES WITH LEADING U. S. NAVY PLANES

COMPARISON NO. 1

Foreign Navy Fighters Attacking U. S. Navy Warplanes

GROUP A: FOREIGN NAVY FIGHTERS—SINGLE-PLACE AND MULTIPLACE

Country	Type of Warplane	Max. Speed in m.p.h. at 15,000 ft.	Crew	No. of guns	War-Service ceiling in ft.	Remarks
Great Britain	Hawker "Nimrod"	210	1	2	35,000	Fastest navy fighter in world
	Hawker "Osprey"	200	2	3	35,000	
Japan	Hawker "Nimrod"	205	1	2	32,000	Licensed from Great Britain
	Nakajima 90	200	1	2	32,000	

GROUP B: U. S. NAVY FIGHTERS, SINGLE-PHASE
(Inadequate speed and ceiling against Group A)

U. S. A.	Boeing F4B-4	185	1	2	27,500	
	Curtiss "Goshawk" F11C-2	180	1	2	25,400	
	Berliner-Joyce XFJ-2	180	1	2	24,700	

GROUP C: U. S. NAVY FIGHTERS, MULTIPLACE
(Inadequate speed and ceiling against Group A)

U. S. A.	Curtiss "Helldiver" F8C-7	160	2	3	22,000	Marine Corps
	Vought V-70	160	2	3	22,300	

GROUP D: U. S. NAVY OBSERVATION, LANDPLANES AND CARRIER PLANES
(Protection required from Groups B and C which they are unable to give)

U. S. A.	Vought V-50	160	2	3	25,000	
	Vought SU-1	165	2	3	25,000	

GROUP E: U. S. NAVY PATROL FLYING BOATS
(Protection required by B, because of blind tails)

U. S. A.	Martin XP2M-1 (121)	120	5	*2	14,600	No tail gun station
	Martin XP3M-1 (120)	100	4	*2	12,500	No tail gun station
	Consolidated P2Y-1	100	5	*2	14,000	No tail gun station

GROUP F: U. S. NAVY AIRSHIPS AND AIRSHIP DEFENDER PLANES
(Airship defender too slow and cannot reach airship ceiling)

U. S. A.	"Macon"	84	81	16	30,000	Three tail gun stations
	Curtiss "Sparrowhawk" F9C-2	163	1	2	21,700	Cannot return to mother ship at altitude nor defend it there.

EDITOR'S NOTE. It is interesting and instructive to compare the status of U. S. Navy planes in the above table with the U. S. Army Air Corps planes of equal rating. (See table in June issue.)

XUM

Another Cloud-Buster is Busted

by KENNETH L. SINCLAIR

The author who, by the way, held Student Pilot's Permit No. 21266, relates the sorrows of the amateur lightplane builder and embryo pilot. He's been through the mill and he knows whereof he speaks.

OLLIE ARTICHOKE was a decent level-headed sort of a cuss. In high school he liked to work in the shop, detested Latin, struggled through math and got somewhat of a kick out of cutting little bugs into small pieces to find out what made them tick. A little peculiar maybe—and again maybe not. But you can't hang a man for wanting to take things apart and see why and how they run.

He graduated and got himself a job. Meantime, he had spent a lot of evenings, when most folks were abed, working in a little leanto alongside his dad's garage. There he built model airplanes, experimented with wings and wing curves, pored over books and magazines and wised himself up generally. In his case, the disease stalked him gradually, waited its chance—and pounced.

* * *

WHAM! One morning Ollie woke up with a lightplane and several loose ideas buzzing around in his head.

Well, there was no turning back. When they reach that stage they're gone and Ollie was only human. He got hold of a four-cylinder motorcycle engine somewhere, took it to pieces fourteen times, put it back together fourteen times, and converted it for lightplane use. Then he spent many a night over the drawing board in the corner of his shop, while his friends cut out picture puzzles on his newly-acquired jigsaw.

On said drawing board there appeared, presently — after many references to weighty books, a little help from a math teacher, and several letters to the professor of aerodynamics at the state university—three views of something that looked remotely like an airplane. In fact, it was a pretty sweet-looking chariot, incorporating some new ideas which Ollie hoped would make him a fortune, to say nothing of the boost they would give to aviation.

"Who knows?" Ollie said to himself, in his heart of hearts. "Boeing tinkered in a workshop—so did Martin and Curtiss and Fokker—"

And so on. Ollie's pencil would stray to the margin, where, among the greasy fingerprints, he would sketch his ship, with himself in the cockpit, zooming and banking among the clouds.

Ollie had a lot of grief, learned a lot of things he had never dreamed of before and spent a lot of time and money. But it was worth it, the day he hooked the bright unscratched tailskid of the Artichoke Special to the spare tire of his dad's coupe and started towing his gleaming new sky-chariot to the town's airport.

VOTE FOR SQUNITCH FOR CORONER
THE PEOPLE'S CHOICE!
AN APPLICANT TO BE EXAMINED, DOCTOR.
HAVEN'T I TOLD YOU NEVER TO BOTHER ME WHEN I'M IN CONSULTATION? HAVE HIM WAIT!
ARTHUR POINTER

Ollie found the doctor, prescribed by the politician, in a dusty two-by-four office practicing golf shots with a waste-paper basket. His main interest was politics.

Being a modest sort of a cuss, Ollie pulled up in a far corner of the field, off by himself, and started hanging the wings on his wagon. Finished with that enjoyable job, he blocked the wheels with a couple of rocks, wound the prop and stood back listening to the sweet drumming of the short-stacked exhausts, watching the shimmering new prop kick over in the sunlight.

He rubbed his greasy palms on his greasier coverall legs, and took a deep breath. The moment had come—but he had the whole thing planned out, down to the last move. He had spent long hours in that cockpit, under the shaded droplight in his shop, working the controls through imaginary situations.

First, throttle. Then, stick forward, all the way. Plenty of rudder to hold her straight as she started to roll. When she picks up speed, and the controls respond, and she gets her nose down to the horizon, ease back the stick and treat the rudder more gently—

He had soaked up all that, and more, from his study of the books. Now he looked up. God's bright blue sky was waiting for him and there was lots of room up there. . . .

* * *

HE CLIMBED into the cockpit. He was going to be very very careful. First, a lot of taxying. Then a short hop. Then another, and another and yet another, until he got the feel of the ship. Then—

A stocky gentleman with a well-fed appearance, a soft gray hat and an expensive cigar, shouldered aside the ring of onlookers and sauntered to the little ship.

"You can't fly that thing here," he said.

Ollie, who was kind of dumb—like all the rest of us—thought maybe his ears were going bad.

"Huh?"

"I said you can't fly that crate here,

nor anywhere else in the state! Get it out of here!"

"Why can't I" Ollie asked, meekly.

"Because I said you can't. I'm Department of Commerce inspector for this district. Where's your license for that wreck? Where's your pilot's license? You haven't got any, and you're damned lucky I'm letting you off easy. Cut that switch and pull this crate out of here tail-first!"

Ollie had a temper, like anybody else, but he managed to keep it in control. "I didn't know I had to have a license," he complained. "I'm not carrying anybody — it's only a one-seater, and I couldn't carry only a toothbrush extra if I wanted to. Besides, I'm not using the highways, and my dad pays taxes for the upkeep of this airport. The state hasn't improved the sky yet, has it? I'm only flying for sport and experience so I can get my license later. I'm not hurting anybody!"

His Highness, the inspector, dusted the ash from his cigar.

"Don't matter. You gotta have a license: one for you, and one for your ship."

"Where do I get a license?"

The overfed inspector turned on his heel, and spoke over his shoulder while he barged through the onlookers. "See me later in my office, kid. I'm busy now."

* * *

OLLIE cut the switch and swallowed his disappointment. He went home with a lump in his throat, and carted his beloved, but useless ship into the garage. Conferences with his folks followed. Ollie had sunk a lot of time and a lot of cash into that ship. What was even more important, it embodied ideas that he was sure would prove valuable. That wing, for instance. . . .

His dad had faith in Ollie's ideas. He offered to advance the money for a flying course: and in the meantime, Ollie could see about having his little ship licensed so that he would be allowed to fly it through God's free sky.

Back to the airport went Ollie. He hunted up a flying school, and found a course that suited him right down to the ground. But first, the instructor said, he must get himself a student pilot's permit.

Ollie hunted up His Highness, the overfed inspector. His Highness was dozing in a comfortable swivel chair.

"Please sir," said Ollie in a meek voice, "I want to find out about a student pilot's permit."

His Highness turned his head languidly. "Costs you ten bucks. Here's a card: go see these two doctors. No— one of 'em's out of town, so see the first one. He'll fix you up."

"But," Ollie objected, "I don't want a transport license. I only want a student permit. Ten dollars— Say, why can't I see my own doctor? He won't charge me anything, and he examines

(*Continued on page* 60)

Describing the Planes Shown on Our Covers

ON the front cover of this issue is a view of the new Waco 2-place pursuit plane. The Waco Aircraft Company plan to sell this type of military plane to the various South American governments, and for this reason the cover drawing shows the official cocarde and tail stripes of Brazil, but the other stripings are not official.

The basic design of this series of pursuit ships is known as Model D, but this is subject to modification according to the engine used and other variations in detail. Thus, when powered with a Wright 420 h.p. engine, it will be model WHD. When powered with a Wasp Jr. engine it will be Model S3HD, and so forth.

Top speed approaches 200 m.p.h. with a 375 h.p. Wasp Jr. (Model S2HD), cruising speed 172 m.p.h. and landing speed is 60 m.p.h. It will climb 1,100 feet per minute and has a service ceiling of 22,400 feet. With standard loading the cruising range is 760 miles. The ship is not only speedy for its rated power but is extremely maneuverable.

Both the pilot and gunner are enclosed within a transparent sliding enclosure, so arranged that the gunner

The Sparrow Hawk—F9C-2.

is normally covered when using the flexible gun.

Now, on turning over to the back cover, we find three planes, which on moving from the top to bottom of the page are a Sparrow-Hawk, a wartime Spad and a view of the famous Italian world's record speed-plane, the Macchi-Castoldi "72".

The Sparrow-Hawk at the top of the back cover, is also designated by the symbol F9C-2. It is a single-seat shipboard fighter provided with a hang-on hook for dirigible service in the U. S. Navy. It has very compact dimensions which are necessary when serving as an auxiliary for the Macon. It has a span of 26 feet and a length of 21 feet, smaller than many lightplanes.

It is not a fast plane, for its service with the dirigible does not call for speed but rather, a low landing speed required for hooking on to the airship. The top speed is 120 m.p.h. while the cruising speed is 105 m.p.h. It lands at 30 m.p.h. and climbs 1,225 feet per minute.

It has a remarkably quick take-off which is explained by the fact that its propeller slip-stream covers 75 percent. of the main wing surface. The little ship take-off in 10 yards and lands in 25 yds. It has a cruising radius of 450

The Macchi-Castoldi "72."

miles, however, so that it can operate at quite a distance from its base.

At the bottom of the back cover will be seen the Italian Macchi-Castoldi "72" seaplane which holds the world's record. It was built in 1931 to compete in the Schneider Trophy Race, but owing to defects in the experimental engine, it was not flown until 1933. The Schneider Trophy Race was won by the English Supermarine seaplane at 408.4 m.p.h. then a surpassing world's record and achievement.

April 15, 1933 marked the transfer of the speed record for on this date, the Macchi-Castoldi "72", made a new world's record of 423.7 m.p.h. over a 3 km. 1.86 mile) course. Over 100 km., (62 m.p.h.), the average speed was 390.8 m.p.h.

It is unique in the fact that a single Fiat A.S.6. 2,500 h.p.h. engine drives two tandem propellers in opposite directions. This reduces the upsetting torque developed by the engines which is further assisted by putting the fuel in the floats. The empty weight is 5,510 pounds while the total weight in flying order is 6,667 pounds.

In fact, this plane is a large flying radiator with its surface largely covered with flat tube radiators for disposing of the tremendous amount of heat developed in the water jackets of the cylinders. Radiators cover the majority of the floats, the float struts, etc.

In the center of the back cover is the familiar wartime Spad 13, shown complete with camouflage. This was one of the most celebrated of the Allied warplanes and gave a good account of itself in many major actions. It was driven by a Hispano-Suiza water-cooled engine which drove it at a speed estimated at from 115 m.p.h. to 125 m.p.h. It is one of the most carefully streamlined ships of that period and had a very high degree of maneuverability.

Many other types of Spads were built, both single and double-seaters and with different classes of armaments, but the Spad 13 is probably the best known of the Spad products.

The Spad 13.

Plane vs. Auto in Industry

by KEITH J. FANSHIER

The various oil companies, after keeping close cost records for their aviation departments, find that the airplane is an efficient, economical and highly satisfactory vehicle for many classes of work.

AIR transportation has been praised for its speed, its dependability, its flexibility, its adaptability and its safety. It has remained for the petroleum industry to discover and establish the point that air transport not only excels in all these elements but can be developed to add to these another very important one; namely, economy.

Oil companies are among the most notable exponents of widespread and diversified experimentation with aviation. They have had some surprisingly interesting results. Not the least surprising is the indicated fact that for certain uses of the industry, they make possible costs of operation far less than those obtainable in any other way for accomplishing similar results.

And, as a further indication of the value of aviation, oil companies seem to have proved that not only can air transportation do various work more economically, but it can do it to better advantage.

Although the oil industry was not interested in providing aviation with such a talking point (it was interested in promoting its own activities and interests) it has brought out this point strikingly in connection with considerable routine operating work which has been done recently in various branches of the industry.

One of the most striking phases of all the work which oil companies have done with aircraft is the employment of them to speed up, improve and render more efficient and easier geological and engineering work in connection with development of oil deposits. In other words, the airplane is being used today as the first means of obtaining an idea as to the location of new oil fields.

When properly used with sufficient experience back of this type of operation, it has been found, according to reports emanating from several companies, that aerial surveys not only increase greatly the accuracy of such activity, but actually reduce the cost of the vast amount of detailed labor in connection with working out preliminary geological and engineering studies.

To a large extent, aerial survey work can supplement and verify the hard ground work which is performed by surface investigations. To some extent it also can and does, it has been proved, replace it. Moreover, it renders the work much more efficient by permitting oil company experts to study completely the contour of a given area which might be virtually inaccessible.

Nature hides its petroleum reserves in out-of-the-way places in the earth's regions. Oil men know it as a definite rule that the tougher the region the better the chance of becoming a rich field. This of course is a colorful and inaccurate way of stating the fact but it seems that most oil fields are located in difficult territories.

So important have aerial surveys become that many of the aviation schools have special courses in this work.

Now, aided by aerial work, oil explorers are able to penetrate and seek out the hidden facts which have caused geologists to revise their ideas of the possibilities of many regions from an oil producing standpoint.

Recently, one well known and active large oil company was able to show some highly satisfactory cost results in connection with company work entirely apart from investigative and geological work. This company and others have come to depend greatly on the use of planes to transport their men on either regular or special and emergency trips.

This company operated a Hornet-powered Boeing 40B mail-plane over a considerable period and kept careful records of its costs—not slipshod, "wishful" records, but actual ones. It was found that over the entire period, costs approximated $45 per flying hour. Figured another way, costs were determined at 39 cents per plane-mile.

This figure includes salaries for both pilots and mechanics. It includes all expenses that legitimately could be included, which takes care of gasoline, lubricants, hangar expense, repairs, replacements or renewals. It also includes taxes, insurance and depreciation. Not much left to guesswork there.

Considering the fact that the plane under consideration carried three passengers besides the pilot, the cost must be considered at 13 cents per passenger-mile and this exclusive of the pilot.

If the company had not been generous in insurance allotments and other outlays, the final figure probably would have been reduced materially. For instance, the insurance carried included public liability and property damage. It also provided for life insurance policies in the face values totaling $100,000 for the four occupants of the ship, a factor which added materially to expense considering the rather high rates. I rather believe that if all such costs were figured on other forms of transportation, some of the ridiculously low figures bandied around in their favor would have to be modified upward considerably.

This was a quite comprehensive test, since the figures represented experiences over a period of three and one-half years, which produced a plane flying time approaching 2,000 hours, distance flown approaching 200,000 miles, total number of passengers approaching 5,000.

The company in question was not only well satisfied with this performance, but considered it economical, especially in view of the time element and the work performed, some of which could have been handled in no other way.

Various oil companies are now coming around to the view that the total cost of operating suitable light pilot-yourself aircraft can be handled so as to be actually less than the current expense of operating automobiles. In fact it is reported that one or two com-

panies are preparing to make extended and thorough investigation of such comparison under representative conditions.

It is particularly attractive for oil companies to consider extensive use of air transport, in the view of some who have gone into the subject carefully, when ground cost of transporting individuals by automobile exceeds 5 cents per mile. On the basis of considering freight, some are now advocating air transport of freight when cost of ground transportation of freight exceeds 10 or 11 cents per mile.

Oil companies, insofar as can be determined from indications developed in experimental work to date, should not be much interested in the more spectacular types of abilities or operations of various planes. For instance, the excessively high rate of cruising speeds commonly discussed throughout the aviation industry is not of supreme importance in the oil industry.

In fact, under some circumstances, extremely low cruising speed is a distinct advantage or even necessary. Take such work as inspection of pipe lines, telephone lines, such as are maintained in some cases over stretches of hundreds of miles, and similar work. Location of trails and similar work can be handled well by aircraft.

While high cruising speed is not particularly needed nor desired for much of the work of the oil industry, there are certain requirements which should be carefully complied with. Above everything else the oil companies want dependability and stability. They want long-range cruising radius.

They, of course, want economy of operation and maintenance as indicated earlier in this article. They want equipment which provides comparatively low landing speed. They want quick take-off and high rate of climb. Large pay-load is also a matter of careful consideration. Construction of the machine should be sturdy and general design should provide flexibility.

From the standpoint of economy alone, it appears that several exceptionally good results have been reported recently by oil companies and companies serving the oil industry in such lines as equipment. Over a period of approximately three and one-half years one of the leading oil supply companies operating on the west coast, was able to chalk up a cost of less than 8 cents a plane-mile for a 4-place cabin monoplane, or less than 2 cents per passenger mile assuming that the machine had been operated with capacity load. (This cost computation did not make allowances for insurance and miscellaneous storage.)

If the oil company is able to supply a large amount of flying of anything that approaches a regular nature, expenses are lowered considerably. Cost of flying decreases quite rapidly as the number of flying hours per year increases.

It has been estimated by several in the trade that the cost per mile for the average employe who could make suitable and efficient use of around 500 hours of air transportation per year the per mile cost involved in his travels should be considerably less by air than by automobile. Naturally the saving in time and general increase in efficiency should make the advantage of the air travel even greater than otherwise.

It frequently has been charged against air transportation that the high percentage of the time-out required because of unsuitable flying weather conditions places it under serious handicap, so far as concerns dependable service. However, when compared with automobile service, oil companies have learned there are two sides to this question.

Further economy factors are being introduced by oil companies. One of the ways of doing this is by elimination of the pilot in flying. This may sound startling. It is not when understood. Oil companies are in some cases now employing petroleum engineers, geologists and other types of employes carrying considerable responsibility from the ranks of those who have been thoroughly trained as competent pilots. Thus the exclusive pilot, or non-paying pilot is replaced by the man who is both pilot and engineer, etc.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-15

Air-pockets. Popular term for imaginary holes in the air which cause airplanes to drop suddenly for a short distance. This is actually due to downward moving currents of air.

Air-poise. Attitude of an airplane in the air.

Air-polarity. The electrical polarity, positive or negative, of the air in respect to the earth or to an electrometer.

Airport. A landing field and buildings for the accommodation of aircraft. A harbor or port for aircraft.

Air-potential. The electrical potential of the air, or its voltage in respect to the earth. The potential increases with the altitude at the rate of about 300 volts per foot.

Air-power. The strength of a government in regard to its air force. Usually this is in terms of the number of planes.

Air-pressure. The force exerted by air on a unit of area, per square-inch, square-foot, etc. The normal pressure of the atmosphere at sea-level is 14.7 pounds per square inch or 2116 pounds per square foot. In terms of a mercury column supported by air, the normal sea-level pressure is 29.92 inches of mercury or 760 millimeters of mercury.

Air-pressure gauge. An instrument for measuring the pressure of air or gases. The mercury column type, called a MANOMETER, measures pressure in terms of the height of column supported. The BOURDON type is a direct reading gauge in which movement of the needle is attained by the effects of pressure on a bent flattened tube.

Air-propeller. A rotating device employed for producing a moving stream of air. As used on the airplane, it is employed to produce a propulsive effect through the reaction offered by the air-stream.

Air-pump. A device for compressing or evacuating air into or from a space. A compressor (pump) increases the air pressure in a vessel. A vacuum pump, or evacuator, removes air from a space, producing a partial vacuum. A rotary air-pump employs rotating gears, impellers or vanes to produce the effect.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-16

Air-reactance. Force produced by the acceleration of a mass of air. This is employed in the lift of aircraft and in the propulsive effects of the propeller.

Air-receiver. (1) A tank for receiving air from a compressor. (2) An intermediate tank between the high and low-pressure cylinders of a two-stage compressor.

Air-resistance. The opposition offered to the movement of a body through air. The resistance to motion is usually given at pounds at a given speed as the resistance varies with the square of the velocity. Air-resistance without causing useful effect is known as PARASITIC RESISTANCE.

Airscrew. An air propeller of the helical type in which the rotation coupled with the forward motion causes the blades to trace a helix or screw-thread curve through the air. A propeller of this type screws its way through the air in approximately the same way that a nut travels on the threads of a screw.

Airship. A lighter-than-air-craft, suspended in the air by the principle of buoyancy and driven forward by some type of engine. Dirigibles come under this classification. The buoyancy is provided by the use of a gas filled envelope which is lighter than the weight of air displaced.

Air-slippage. The amount by which a column of moving air fails to maintain the velocity of the impelling medium.

Airspeed. The speed of a body in respect to the undisturbed air through which it moves. This is not necessarily the speed in respect to the earth unless the air is calm and without movement. The velocity in regard to the earth is called the GROUND SPEED. The speed is usually given in terms of miles per hour or feet per second.

Airspeed-Meter. A device for measuring the speed of a body through the air by the impact pressure produced by the air on the recording mechanism. Thus, the pressure produced on a vane may be employed as an index of the airspeed.

Air (Standard). Air taken as a standard for reference. Standard air at sea-level and at 59°F (15°C) weighs 0.07651 pound per cubic foot. The mass density is 0.002378 and the specific volume is 13.07 cubic feet.

Britain's Imperial Airways

An important and interesting history is given here. It is the history of the Imperial Airways, one of the greatest aerial transportation systems in the world, and being prepared by officials of the company, the history is authentic.

THE first ten years of a British national effort to establish air transport on definitely commercial lines have just been completed.

It was in 1923—after various schemes of subsidies had been experimented with—that the Government appointed a special committee to advise as to the best way of assisting air transport in the future.

The committee suggested the creation of a single national organization to be aided by subsidies on an annually decreasing scale. It was to give effect to this recommendation that Imperial Airways came into existence in April, 1924, its mandate being to establish British air transport as soon as possible as a self-supporting industry. The first phase of the Company's operations was a co-ordination of the data gained by the organizations which had been absorbed, and also a general survey of the economics of air transport.

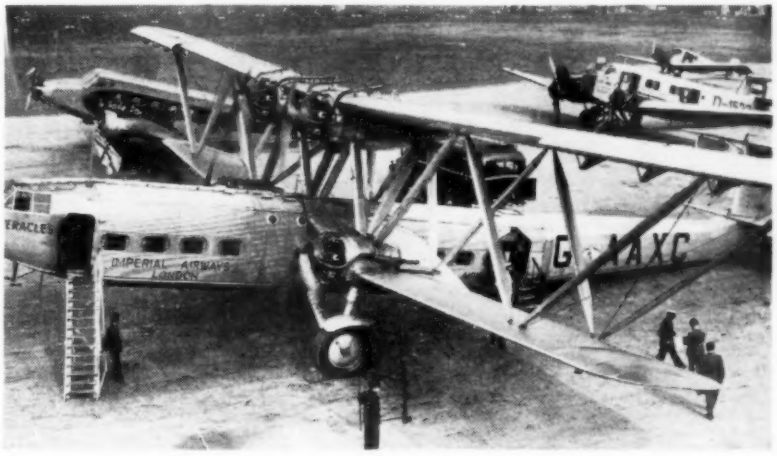
One of the decisions reached was that any large traffic expansion in Europe was of secondary consequence in view of the competition of subsidized foreign companies, and of the highly-developed system of rail communication. While, therefore, the organization and equipment of such continental services as it was found advantageous to operate was improved, it was decided to concentrate on plans for those long-distance Empire routes which have since been, and still are, the Company's main concern.

* * *

THE first link in the chain of Imperial air communication, that between Cairo and Basra, was established in January, 1927. Two years later this service was extended east and west to form a regular air-mail route between London and India.

In 1930 came an agreement for a weekly Cairo-Capetown airmail, the first sections being opened in February, 1931. A year later it was found possible to continue the route southward, enabling passengers, mails, and freight to be air-borne through from London to Capetown.

In July, 1933, the Indian air-mail was extended to Calcutta, and in September to Rangoon. In December of the same year a further link was established to Singapore. Towards the end of the present year it is hoped to complete the through route of 11,000 miles between England and Australia. This summer, also, it is planned to eliminate on Empire routes the train link between France and Italy, replacing this by aircraft stages; while investigations continue as to the operation of an Atlantic airmail between Great Britain, Canada, and the United States.



The Heracles type biplane transport employed by the Imperial Airways on its routes between London and Paris. 38 passengers and a crew of four are carried.

Turning to home air transport, a new organization, Railway Air Services, was established recently by the chief railway companies and Imperial Airways to operate internal air routes within the British Isles. This summer—so far as arranged at present—services will be flown between London and the Isle of Wright; between London and Glasgow via Belfast; and between Plymouth, Cardiff, and Birmingham, with a possible extension to Liverpool.

* * *

FROM year to year since 1924, in addition to a development of routes and organizations, there has been active progress with aircraft used by Imperial Airways.

Ten years ago the aircraft taken over from the previous companies comprised a miscellaneous fleet of eight different single-engine and twin-engine types, some of these aircraft being of military design modified for civil use.

In the first air-liners ordered by Imperial Airways, and delivered in 1926, an endeavor was made to combine, in an essentially transport type, as much as possible of the experience already gained. The result was a machine built largely of steel, and driven by three motors developing a total of 1,155 h.p., a feature of this power-plant being that any two of the motors would maintain the machine in flight when carrying a full load.

Accommodating 19 passengers, and carrying a steward to serve refreshments, these airliners—the "Argosies"—fully justified all expectations, and initiated the Imperial Airways policy of large multi-engined aircraft.

It was from the "Argosy," as loads increased and further experience was obtained, that Imperial Airways proceeded to still larger land-planes and flying-boats driven by four engines. Space does not permit a description of each succeeding type, and for the same reason, the characteristics of the chief units of the Company's existing fleet can be given only in a summarized form.

Flying between London and Paris are the 4-engined "Heracles" type, carrying 38 passengers and a crew of four. Machines of approximately the same type—the "Hannibal" class—but with different accommodation and equipment, are in operation between Cairo and Karachi, and on the Africa route.

Built for high speed at high altitudes in Africa and the East is the 4-engined 1,360 h.p., "Atalanta" monoplane airliner. Having accommodation for 9 passengers, a crew of two, and nearly a ton of mails and baggage, this machine cruises at 120 miles-an-hour, with a maximum of 150 miles-an-hour.

On Mediterranean sections the 4-engined 2,200 h.p., "Scipio" flying-boats operate, carrying 16 passengers, a crew of four, and three-quarters of a ton of mails and freight. One of the latest Imperial Airways fleet units is the 4-engined "Scylla"—the largest airliner to be built so far for service on any regular route. Its saloons seat a total of 39 passengers, one of these saloons being equipped as a smoking compartment.

Another new airliner—the fastest 4-engined passenger-plane so far produced—has been built for Imperial Airways and Qantas Empire Airways in connection with a tender for the air-mail extension to Australia. This machine, the De Havilland 86, which is also to be used on certain continental

routes and by Railway Air Services on British internal airlines, is driven by four engines developing a total of 800 h.p. Carrying up to 10 passengers, it cruises at 145 miles-an-hour, and has a maximum of more than 170 miles-an-hour.

In air transport speed is of course vital, and here the Imperial Airways policy is one of gradual acceleration, speed-ups being introduced immediately they can be proved to be economic, and are combatible with the Company's standards of regularity and comfort.

The service to India began with a flexible schedule of 7¼ days. As experience was gained this was shortened to just over 6 days. With this summer's schedules the journey will be speeded up so that it occupies only 5 days. On the Africa route the first London-Capetown schedule was one of 11 days. Then it was reduced to 10 days. With this summer's schedules it will be shortened to 9 days.

Technical and other improvements, and a wider adoption of night-flying, will enable further speed-ups to be effected in due course. It is hoped also that a growth in loads, and particularly in mail loads, will permit Imperial Airways to increase the frequency of their services.

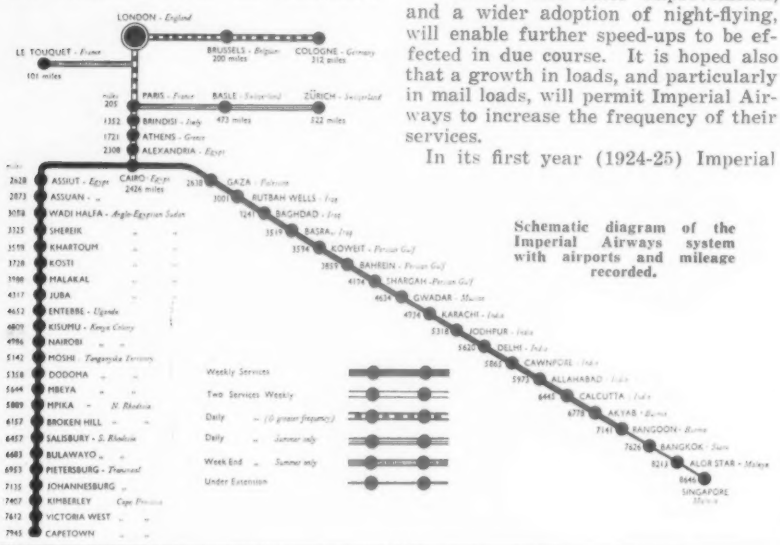
In its first year (1924-25) Imperial Airways operated over 1,760 miles of continental routes, flying a total of 853,024 miles, and carrying 11,395 passengers and 26 tons of mails and freight.

During a recent period of twelve months the aircraft of the Company were flying over 14,000 miles of continental and Empire routes, covering a total distance of 2,355,834 miles, and carrying 59,966 passengers, and 882 tons of mails and freight.

Altogether, taking the latest figures available, the Company has carried since its inception more than 300,000 passengers and over 7,000 tons of mails and freight; while in regard to the all-important question of reliability the percentage of flights cancelled has been reduced from 23.25 in 1924 to 1.55 in 1934.

The airlanes of Imperial Airways are the longest in the world, surpassing even those of the United States, and pass over the most interesting of countries in Europe and Asia. Besides serving a very useful purpose for Great Britain it promises to become a popular line with tourists.

To consistently operate such a long stretch of airway requires a strong organization and a personnel out of the ordinary. The percentage of accidents has been low while the reliability factor has constantly improved until it has become even more consistent than the reliability of many railroads operating in more favorable territory.



Schematic diagram of the Imperial Airways system with airports and mileage recorded.

AERODYNAMICS—AER-WI-50

LIFT AND DRAG COEFFICIENTS

ENGINEERING UNITS. This system, very commonly used by designing engineers in this country, is very convenient as the units are in terms of pounds, square feet and miles per hour. There is no necessity for making conversions. The symbols are as follows.

Let: K_y = Lift coefficient, standard air at sea-level.
K_x = Drag coefficient, standard air at sea-level.
A = Projected area of wings, in square feet, or: Span x Mean Chord in feet.
V = Velocity of air in miles per hour.
L = Total lift of wing in pounds.
D = Total drag of wing in pounds.

Then;

$$\text{Lift} = L = K_y \times A \times V^2, \text{ or, } L = K_y A V^2 = \text{Pounds}$$

$$A = \frac{L}{K_y V^2} \qquad K_y = \frac{L}{A V^2} \qquad V = \sqrt{\frac{L}{K_y A}}$$

Example: Let us find the lift of a wing where the known value of the lift coefficient K_y is 0.0005, the area is 150 square feet and the velocity of the air is 100 m.p.h.

$L = K_y \times A \times V^2 = 0.0005 \times 150 \times 100 \times 100 = 750$ pounds.

The total drag (D) of the wings is found in the same way except that K_x is employed instead of K_y. Thus, in the same problem as above, let us say that the drag coefficient K_x is known to be 0.00002 for this wing. The total drag is:

$D = K_x \times A \times V^2 = 0.00002 \times 150 \times 100 \times 100 = 30$ pounds.

It should be understood that the values of both K_x and K_y are experimentally determined by the laboratory, and that these values are obtained from the laboratory reports.

WING EFFECTIVENESS. The effectiveness of a given wing is given in terms of the ratio of the lift to the drag, or the "lift-drag" ratio. Thus, if L is the lift and D is the drag, both in pounds, then the lift drag ratio is:

Lift-Drag ratio = L/D, or, K_y/K_x

In the problem above, the lift-drag ratio = L/D = 750/30 = 25

AERODYNAMICS—AER-WI-51

LIFT AND DRAG COEFFICIENTS

N.A.C.A. UNITS. The National Advisory Committee for Aeronautics has devised an absolute system of lift and drag coefficients which are extensively employed in the United States. This system, known as the "N.A.C.A." system must be carefully distinguished from the "Engineering Units."

C_L = Lift coefficient.
C_D = Drag coefficient.
S = Area (projected) in square feet, (or square meters).
p_0 = Mass density of air (0.002378 for standard air).
V = Velocity of air in feet per second (or meters per second).
q_0 = Dynamic pressure of air = $p/2 \times V^2$, standard conditions.
L = Total lift in pounds.
D = Total drag in pounds.

Then:

Lift = $L = C_L \times p/2 \times S \times V^2$ = pounds, or:
$L = C_L \times q_0 \times S$

The value of q at any other density than standard density, or at elevations above or below sea-level is obtained from:

$$q = q_0 \times \left(\frac{p}{p_0} \right)$$

Where p is the new density at an elevation above or below sea-level, and p_0 is the standard value at sea-level. The relation between the velocity in standard air and air at a given dynamic pressure is:

$V' = 29\sqrt{q}$ = feet per second at new value.

DRAG = $D = C_D \times p/2 \times S \times V^2$ = pounds, or,
$D = C_D \times q_0 \times S$

WING EFFECTIVENESS. The effectiveness of a wing is given in terms of the "lift-drag ratio", or L/D. Using the coefficients,

Lift-drag ratio = C_L/C_D

What Causes Bad Bumps

by J. C. BARTON

Many queer accidents have happened from time to time in which the airplane seemed to drop suddenly and crash to ground with no apparent reason. This is a particularly frequent landing accident.

ALL THE world has heard of "air-pockets," the favorite phrase used by the daily press in describing the cause of a crack-up. And while this expression is descriptive, in a certain sense, yet it conveys the erroneous impression that vacuous holes actually exist in the atmosphere in which the unfortunate airplane meets its fate.

As a matter of fact "holes as holes" do not exist, nor could vacuous patches be logically assumed to maintain their form in free air with high pressure air surrounding them. Actually, the accidents in most cases are due to local thermo circulations of the air that suddenly reduce the relative air-speed over the wings, thus reducing the lift and causing a sudden and unexpected descent of the plane. The heat of the sun on a hot calm day in summer is primarily responsible for the accidents usually attributed to "pockets."

Now, as we all know, the airplane is sustained in flight by the reaction of an air-stream flowing past the wings—the lift depending, among other things, upon the velocity of the air in respect to the wings. This air velocity, based on the wings, is called "air-speed" and must be carefully distinguished from "ground-speed" or the speed of the ship in respect to the earth.

Let us say, for example, that the lowest possible air-speed that will sustain a certain plane in flight is 40 m.p.h. in calm air. A sudden gust of wind, assumed to be blowing into the front face of the plane or against the front edge of the wings will increase the relative air-speed for that instant. The lift will thereby be increased while the inertia of the plane will hold it momentarily so that there is also a brief climb. In the same way, a vertical ascending current of air, due to deflection from surrounding hills or by thermal circulation, will also produce climbing so long as the air column acts on the wings.

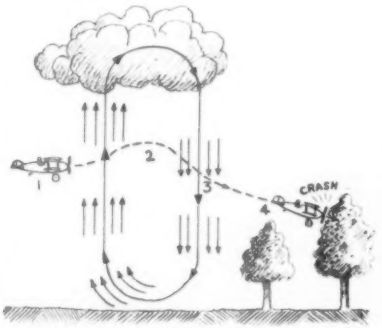


Fig. 1. A thermal circulation of vertical air currents.

If the plane is travelling horizontally at the rate of 40 m.p.h., and strikes a gust head on that has a velocity of 15 m.p.h., then the effective relative air-speed over the wings is the sum of the two velocities or: 40+15=55 m.p.h. This means that the plane will climb until the air velocity is reduced or until the pilot readjusts the control surfaces to meet the new conditions. Such impacts of air justify the word "bumps" for the plane responds very quickly and vigorously to such gusts by jumping abruptly.

Now, let us assume the reverse case where the gust comes up from behind or blows "on the tail" of the plane. The air-speed is now reduced, so far as the wings are concerned, and a sudden descent or drop takes place—apparently as though the plane had run into an empty hole or deep well with all support withdrawn. Cases have been cited where the plane has dropped several hundred feet under such conditions and if too near the ground —well, it is just too bad.

As an example, let us say that a wind gust of 15 m.p.h. acts on the tail of a ship travelling 40 m.p.h. Under such conditions the relative speed of the air over the wings is the difference of the ship's speed and the gust speed, or: 40−15=25 m.p.h. The lift is now lost if the minimum flying speed is 40 m.p.h. and the plane drops like a rock until the gust abates or until the pilot has time to readjust the ship's controls so that it again regains the proper air-speed. This loss of air-speed and lift can be attributed to several causes, and unless prompt correction is made by the pilot, an accident is certain, particularly in making a landing or taking off. It occurs with great suddeness and without warning for, unfortunately, gusts and air-currents are not visible.

A cause of bad bumps and sudden losses of altitude are the vertical thermal currents illustrated in Fig. 1. Here, the hot sun shining on the earth superheats the air near the ground and starts a vertical circulation of the air locally, the warm light air ascending along (2) to form cumulus clouds above. Then, after being cooled at the high altitude, the cool air descends along (3). Such vertical streams frequently attain very high velocities and have a very noticeable effect upon the plane.

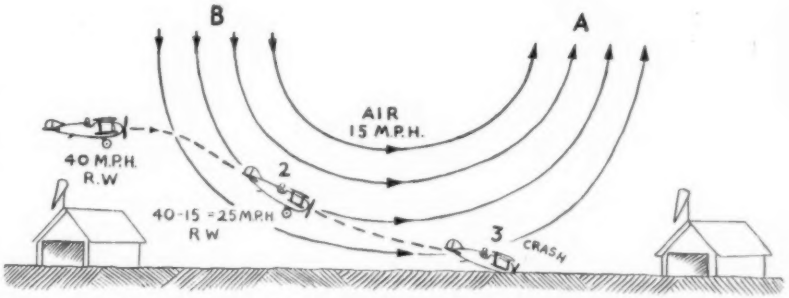


Fig. 2. Loss of air-speed when near the ground caused by the horizontal component of a thermal circulation of air.

As shown, a plane in horizontal flight at (1), approaches the disturbance. It meets the ascending air and is carried to a somewhat higher elevation at (2). At (3), it encounters the down-comer (3) and loses so much altitude that it will plunge into the tree-tops at (4) if the pilot does not act promptly. It will crash into the ground if the ship is at a lower elevation. This is one cause of an apparently mysterious accident where an airplane, sailing smoothly along, drops suddenly without any evident reason.

In Fig. 2, we show a close-up detail of a similar thermal circulation near the ground, the air descending at (B) and rising at (A). As shown, the lower circulating air travels horizontally along the ground for a consider-

(*Concluded on page* 45)

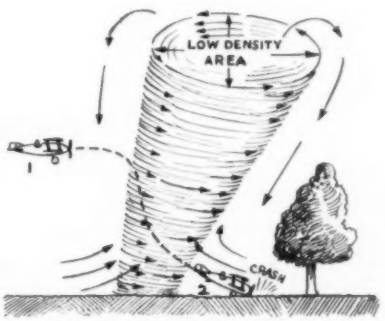


Fig. 3. A miniature tornado or "dust witch" which has caused crashes.

An Aviation Engine Quiz

Compiled by P. A. Technical Staff.

This is the third of a series of questions and answers on the elementary principles of the gasoline aviation engine.

Q. How far does the pressure exist during the working stroke?

A. To the farthest end of the stroke, but the pressure decreases rapidly. Beginning with 300 pounds per square inch, for example, at the beginning of the stroke, it falls off to 30 to 50 pounds per square inch when the exhaust valve opens at the end of the working stroke.

Q. Then, opening the exhaust valve at such high pressure causes the snappy roar at the exhaust?

A. Yes. To avoid the barking exhaust, the pressure must be below 10 or 12 pounds per square inch when the valve opens.

Q. I should imagine that liberating the gas under such high pressure would cause a loss of power?

A. It does. When the exhaust valve opens, from 25 to 35 percent. of the available energy rushes out into the air and is lost.

Q. What is the average pressure throughout the stroke?

A. The average pressure on the piston is called the MEAN EFFECTIVE PRESSURE (M.E.P.). This again depends upon many factors such as the compression, cooling, valve timing, volumetric efficiency, etc. In general, it will range from 110 to 140 pounds per square inch, the average probably being about 120 pounds per square inch at maximum output.

Q. What is meant by the abbreviation B.M.E.P.?

A. This is the abbreviation for "Brake-mean-effective-pressure," or the effective pressure as determined on the dynamometer at maximum horsepower.

Q. Of what interest is the M.E.P. or B.M.E.P.?

A. This being the pressure that is effective all through the stroke, it represents, therefore, the force applied to the crankshaft from beginning to end of the stroke and is used in power computations. To a certain extent, it is representative of the thermal efficiency.

Q. What causes the drop in pressure when the piston starts moving ahead on the working stroke?

A. The moving piston increases the volume of the gas in the cylinder, allowing it to "expand." The increase in volume causes a corresponding loss in pressure because the temperature falls off.

Q. Name the two systems of expansion.

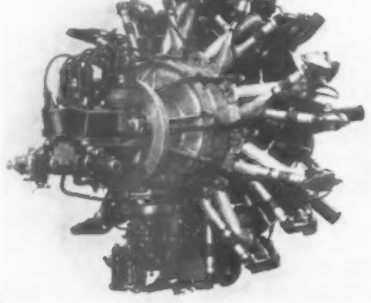
A. When the gases remain at a constant temperature while being expanded the process is known as ISOTHERMAL EXPANSION. This does not actually occur in an engine cylinder. When heat is prevented from either entering or leaving the cylinder during expansion, so that the temperature reduction is due simply to the expansion, this process is known as ADIABATIC EXPANSION.

Q. Which type of expansion takes place in practice?

A. Neither, in its entirety. Because of the cooling system around the cylinder, heat is being continually removed from the gases, hence the pressure reduction during expansion is much more rapid than with isothermal expansion and somewhat greater than with adiabatic expansion. In other words, if the m.e.p. were 125 pounds per square inch with true adiabatic expansion, the actual m.e.p. would be about 116 pounds per square inch.

Q. If cooling causes heat loss, why is it used?

A. If the cylinders were not cooled, it would be impossible to lubricate them at any time and eventually they would be burned out because of the high temperatures.



A typical radial air-cooled aviation engine.

Q. What is the highest gas temperature in the cylinders?

A. This is a difficult question to answer because the temperature depends upon so many variable factors. Some investigators claim that temperatures as high as 3,000°F. have been measured directly after ignition, while others claim that the temperature cannot possibly exceed 2,000°F. A fair average would be 2,500°F.

Q. Is the average or mean temperature known?

A. More reliable information is had on the average or mean temperatures. These are quoted at 750°F., 900° F. and 1,000°F., by various authorities, the results depending somewhat on the compression pressure, cooling methods, etc. It is likely that 950°F. at full load would be a fair figure all through the cycle.

Q. Is this reduction due entirely to expansion?

A. No. It is partly due to the fact that the cylinder is cooled off to some extent during the suction stroke by the incoming cold mixture, more of the heat is removed by cooling and some by radiation.

Q. When temperature is lost by expansion alone, what becomes of the heat?

A. During true adiabatic expansion, when no heat enters or leaves the cylinder, the drop in temperature at the end of the stroke indicates the amount of work done by the engine. In other words, if the final temperature of the gases was the same as the temperature before ignition, then 100 percent. of the heat would be converted into mechanical work.

Q. What are the principal heat losses in the engine?

A. Losses through the exhaust vary from 25 to 35 percent. while the losses due to cylinder cooling may be somewhat higher, depending upon conditions. At slow speed and underloaded, the gases are in contact with the cylinder longer and the heat loss to the cooling system is greater. When heavily loaded, more of the heat passes out through the exhaust because the exhaust pressure (terminal pressure) is higher.

Q. Name other heat losses that take place in the engine.

A. Some loss is due to the fact that not all of the mixture or fuel is completely burned due to incorrect proportions of fuel and air. Again, certain of the gasoline compounds are decomposed by the heat so that this portion of the fuel is not then available for producing power.

Q. Is this loss serious?

A. Yes. Losses due to incomplete combustion, or to "poor carburetion," may be quite high. It is impossible to give a figure for these losses because they vary with the carbureter adjustment, with temperature and the type of carbureter.

Q. Is there any way of determining whether the mixture is correct?

A. Yes. The most accurate method is by chemical analysis of the exhaust. Second, is a rough approximation by noting the character of the exhaust gases.

Q. Describe the method of exhaust analysis.

A. An apparatus known as a "CO_2 Recorder," is attached to the exhaust pipe which shows the percentage of carbon dioxide gas in the exhaust. If the fuel is completely burned, the percentage of carbon dioxide will be high. If combustion is incomplete and wasteful, this figure will be low.

Q.—What does a great percentage of carbon dioxide mean?

A. Carbon dioxide is the lowest form to which carbon can be burned and denotes complete combustion. A high percentage of carbon dioxide, therefore, indicates, that most of the fuel is being burned. If not completely burned, the carbon forms carbon monoxide gas.

(Concluded near bottom of page 64)

Designing the Morvay "ALERTE"

by ANTON ALLAN MORVAY

Having arrived at the preliminary dimensions on the June issue of P. A., Mr. Morvay now takes up the matter of preliminary performance estimates. Be sure to follow this step-by-step series on lightplane design.

LAST month we worked up some basic figures in the design of the "Alerte" lightplane and drew a preliminary sketch of the proposed ship. In this issue, we will take up the preliminary performance analysis. This of course involves some mathematics, and although in the final design the values given entail considerable research work and laborious calculations to insure even a small measure of accuracy, in these preliminary estimates we will hold ourselves down to ordinary arithmetic.

The standard procedure in this work is, first of all, to itemize the various factors influencing the performance of the ship, together with the information regarding the flying characteristics that it is desired to be known. Putting them down in order, we have the following:

(A) POWER REQUIRED:
- (1) Gross weight
- (2) Wing area
- (3) Equivalent monoplane aspect ratio
- (4) Lift and drag coefficients of the wing
- (5) Parasite drag coefficient
- (6) Power required curves for sea level and altitudes.

(B) POWER AVAILABLE:
- (1) Brake horsepower and r.p.m.
- (2) First approximation of high speed at sea level
- (3) Propeller diameter
- (4) Efficiency of propeller against speed
- (5) Power available at sea level
- (6) Power available at altitudes.

(C) PERFORMANCE CHARACTERISTICS:
- (1) High speed (second approximation) at sea level and altitudes
- (2) Reserve power (first approximation) and rate of climb at sea level and altitudes
- (3) Absolute and service ceiling. Time to climb
- (4) Landing speeds at sea level and altitudes
- (5) Range
- (6) Endurance.

* * *

Starting with (A) we can put down the following values:

(1) Gross Weight=828 lbs.
(2) Wing Area=150 sq. ft.
(3) Upper Wing Span (b_1)=24 ft.
Upper Wing Area (Su)=90 sq. ft.
Upper Wing Chord=4 ft.
Lower Wing Span (b_2)=18 ft.
Lower Wing Area (S1)=60 sq. ft.
Lower Wing Chord=3.5 ft.
Gap=4.5 ft.

$$\text{Mean Span (b)} = \frac{24 \times 18}{2} = 21 \text{ ft.}$$

$$\text{Ratio of spans} = \frac{b2}{b_1} = \frac{18}{24} = .75$$

$$\frac{\text{Gap}}{(b)} = \frac{4.5}{21} = .214$$

(3) The Equivalent Monoplane Aspect Ratio (E.M.A.R.) is a term used to define the relative aspect ratio of a biplane having the same induced drag coefficient as a monoplane.

$$\text{For a monoplane, the E.M.A.R.} = \frac{\text{Span}^2}{\text{Area}}$$

$$\text{For a biplane, the E.M.A.R.} = \frac{\text{Area}}{C_1^2 + (2\emptyset C_1 C_2) + C_2^2}$$

where
- C_1=Area of upper wing divided by span of upper wing
- C_2=Area of lower wing divided by span of lower wing
- $\emptyset$=a biplane interference factor, which is dependent on the ratio of gap to average span. In our case it has a value of .42

Therefore, the E.M.A.R. in our case is equal to the following:

$$\frac{150}{(14) \quad (.84 \times 3.75 \times 3.33) \quad (11)} = \frac{150}{35} = 4.25$$

(4) In performance calculations of this kind, the lift of the wings is considered equal to the gross weight. Under normal horizontal flight conditions, it is assumed to be constant. At least for the purpose of this paper, it will be taken as such.

The air force coefficients are a function of the wing loading and the speed of horizontal flight; in Absolute units they are expressed as follows:

$$C_L = \frac{W}{.00255 \times S \times V^2 \times \Phi}$$

where
- W=the gross weight
- V=velocity in m.p.h.
- S=the total wing surface
- Φ=the density ratio for any given altitude.

Transposing, we get

$$C_L = \frac{828}{.00255 \times 150 \times 22{,}500 \times (1)^*}$$

(*)=at sea level.

This gives us a value of .0969 at 150 M.P.H.

The lift coefficient, tabulated against various speeds is worked up in the form shown in Figure 3. The speed of the airplane is broken down into steps of even units of 10 M.P.H. each, starting with the minimum speed. The value of this speed is found as

$$\text{Minimum Velocity (V min.)} = \frac{W}{.00255 \; S \; C_L \; \Phi}$$

Of the half dozen or so different wing sections suitable for a job of this kind, let us pick the old standby, Clark Y. While there are more efficient sections for high speed work than this, it cannot be beat for all-round performance. Its maximum coefficient of lift, under normal loaded and powered conditions is about 1.56, which would give us a minimum speed of 35 to 40 M.P.H.

Filling out the above equation with a maximum C_L=1.35, we get a minimum speed of 40 M.P.H.

The wing drag, at various speeds, to be entered in Fig. 3 is expressed by the induced drag coefficient

$$C_{Di} = \frac{C_L^2}{\text{E.M.A.R.}}$$

(*Continued on page* 56)

Figure 3

Velocity V	Velocity Min. V	C_L	C_{Dt}	C_{Do}	C_{Dp}	C_D	H.P. Req. at sea level	10,000 Ft. V	10,000 Ft. H.P.
40	1.00	1.35	.1365	.026					
50	1.25	.866							
60	1.50	.601							
70	1.75	.441							
80	2.00	.338							
90	2.25	.267							
100	2.50	.216							
110	2.75	.178							
120	3.00	.150							
130	3.25	.128							
140	3.50	.110							
150	3.75	.0969	.00072	.0090			100		

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Read and Rejoice!

FIRST-OFF, at the top of the column, we see the latest version of Les Long's Harlequin-Longster, powered with a 35 h.p. Harlequin engine. But this is only part of the story—just gaze upon the pleasing mien of the young lady who may, or may not, be an aviatrix.

Getting back to the ship (with reluctance), Les Long says that it holds the world's record for climb per gallon of gasoline (unofficial) in the light-plane division. It climbed 11,000 feet above the field in 30 minutes on 1½ gallons of gas. This is sure some climbing performance for this type of ship.

Second on the program is an Air Camper built by the Unknown Birdman and his friend. He is afraid to give his name, fearing that it will call down the vengeance of the State department on his head. Just one more case where state laws make fugitives out of earnest young men who wish to fly.

The Unknown Birdman states that about two years' time was spent on the construction of the little ship because of the well known Depression, and it was assembled piece by piece as they were able to spend the money. The Ford engine was taken from a burned car, but it had only a few thousand miles on it.

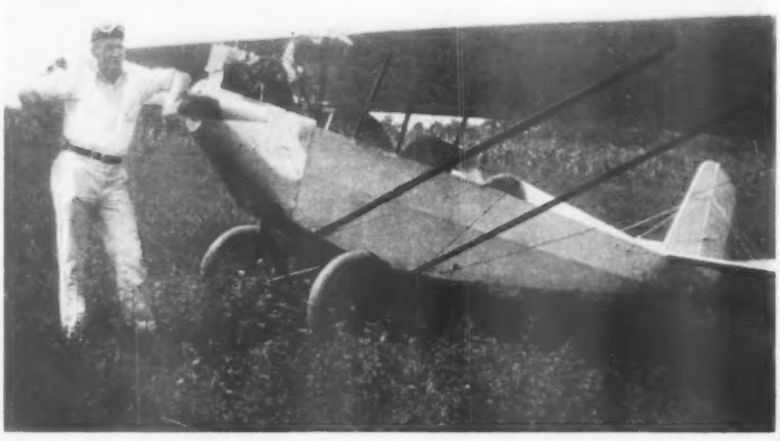
A special high-compression head is being used which boosts the power considerably and Henry's kicker delivers plenty of soup to the prop. So far the builders have only done some grass-cutting, but the ship was test-hopped by the president of a local flying club. It has been inspected by several transport pilots who have pronounced it O. K. and also by a Department of Commerce inspector who found no fault with the ship and gave them an identification number.

Last, but not least, is the contribution of Adrian Bambini, 38 Tyler Street, Hyde Park, Mass. It is slightly cracked due to a forced landing in a barnyard, caused by a leaking feedline, but the injuries are minor ones. He only slapped the hayrake and broke a wing tip.

This ship, which is of Adrian's own design, has a span of 22'-0" and an overall length of 13'-0". It is powered with a four-cylinder water-cooled Bugatti engine which revs at about 3,400. It is of wood construction throughout and is both light and sturdy. That the latter is true is easily understood from the fact that anything remains at all after a sudden descent from 100 feet into a bit of husky agricultural machinery.

Here Are Three of Our Readers' Products

Les Long is taking away a lot of interest from the Harlequin-Longster plane by displaying his girl friend with it. However, we all know that the Longster is a fine ship—especially when built by Les himself.



Meet the Unknown Birdman at the left and the Air Camper at the right. Yes, that is a 4-cyl. Henry roosting in the prow of the caravel. The proud owner of this ship is doing some bootleg flying (or hopping) and is thereby incognito. No—we haven't got his name.

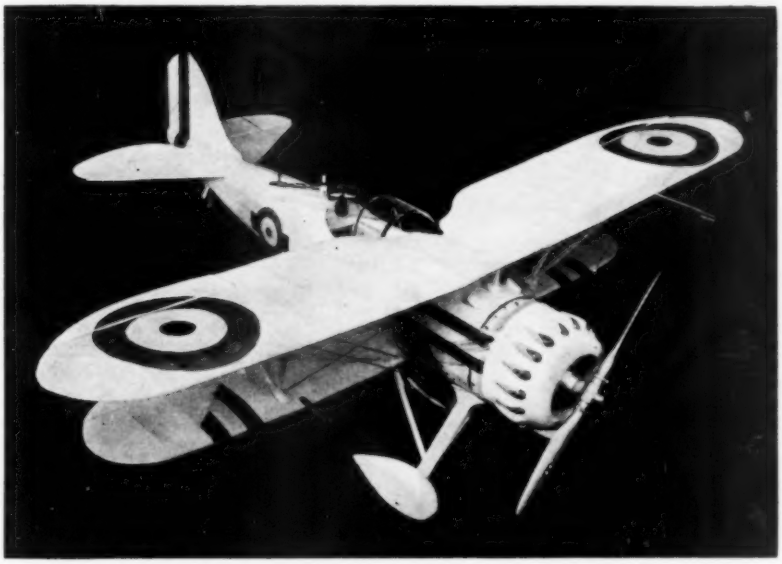
We are standing at the South end, looking North, at the creation of Adrian Bambini who dwelleth in Hyde Park, Mass. If Mr. Bambini would only stage his barnyard landing act, we are sure that he could clean up good money on the big-time circuits.

A Model of the Waco "D" Pursuit

by

PAUL W. LINDBERG

Model editor and designer for
POPULAR AVIATION.



This Waco "D" pursuit ship is complete down to the machine gun and bombs. It is provided with special shock-absorbers, movable control surfaces and all the fixin's.

THE Waco Model "S2H-D" two-place pursuit plane is another outstanding ship, of which we are very proud to present to the Model Builders.

Our laboratory has taken a great deal of time in producing an authentic flying scale model, which we are sure will give you many enjoyable hours while constructing and flying it. During test flights speed and stability were very notable features. Flights averaged between two and three hundred feet.

Study the plan carefully and note the many improved features in model airplane construction, such as; foolproof shock absorber, false ribs, adjustable controls with aluminum hinges and all details to make it a finished model.

In building the model, all dimensions can be quickly and accurately determined by placing a ruler on the part to be measured. The plan is printed full size. If you wish a larger model, multiply this measurement by the amount of increase. The color scheme can be obtained from the cover of this issue.

CONSTRUCTION OF FUSELAGE

The fuselage sides are built from 1/16 inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented by inserting straight pins on either side of strips wherever needed.

After the two sides are completed, they are pinned to the top of the plan in such a manner that the top longerons face down and so that the sides form right angles with the surface of the plan. The cross-members are now cemented in their proper locations. Cut formers from 1/32 inch sheet balsa and cement in their respective positions as shown on the plan.

The balsa ring which fits on front of fuselage, is carved from a solid block or built up from ⅛ inch sheet balsa. After this has been properly shaped and sanded cement to front end of fuselage.

The 1/32x1/16 inch stringers should now be cemented over the formers on fuselage. Please note that the stringers are cemented to outer edges of formers so that a smooth covering job may be obtained. This eliminates all projecting formers.

A stiff grade of paper is used for cockpit cowling between formers two and three.

MOTOR COWLING

This is made from a block of balsa, carved and sanded to shape as shown on the plan. Use a stiff grade of paper for rear part of cowl. When properly cut, cement to balsa ring. This completes the cowl, with the exception of the eighteen fairings around outside of cowl.

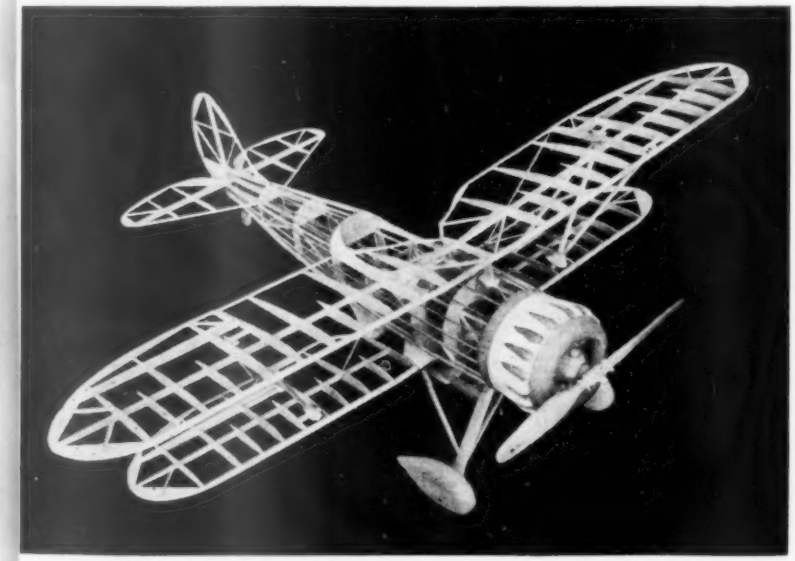
DUMMY MOTOR

The motor is built up entirely from balsa and sheets of paper. The cylinders are built first using the sheets of paper cut into disks, etc., to represent the fins. The layers in between these are made of sheet balsa 1/32 inch in thickness.

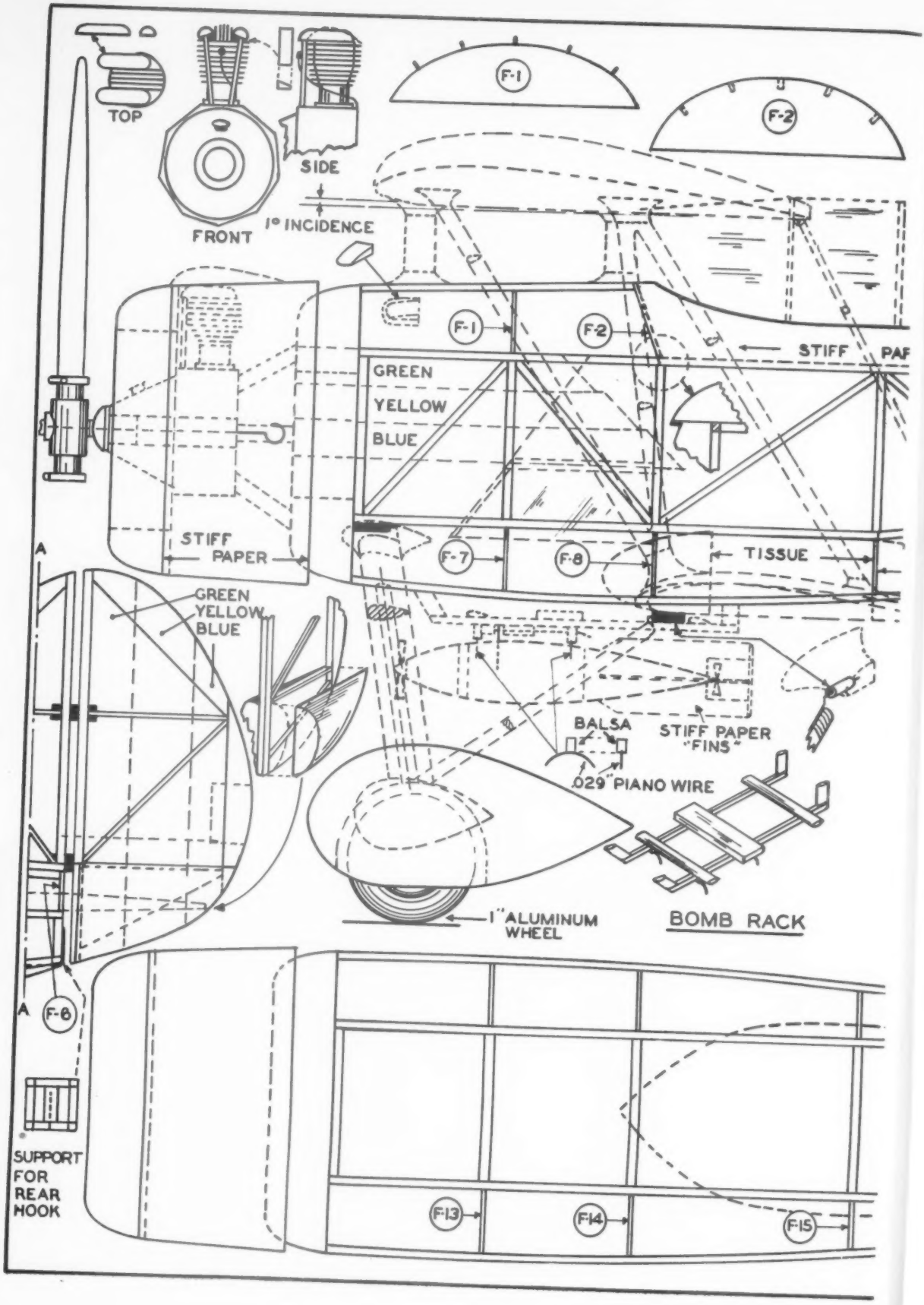
These are cut smaller so as to make the cylinder more realistic. The crankcase should be made from layers of ⅛ inch stock, cemented together and shaped as shown on the plan. A solid block of balsa may be shaped up equally as well. After the cylinders and crankcase have been completed, cement the nine cylinders in their proper locations on the crankcase.

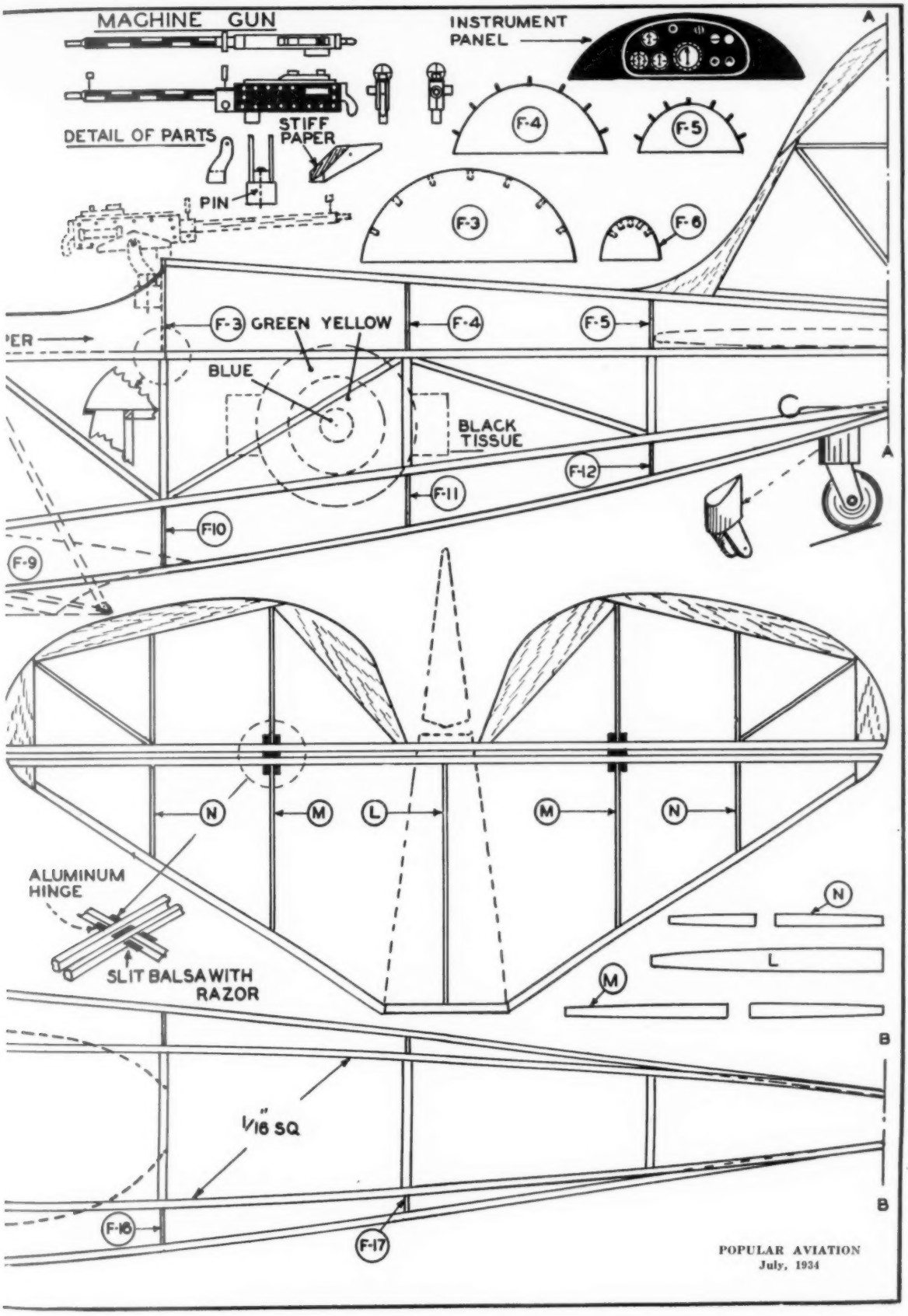
The rocker-arm caps and push-rods

(*Concluded on page* 58)



The frame of the Waco "D" before covering shows a construction that is strong and rugged and yet one that is light and practicable.


TOP
SIDE
FRONT
1° INCIDENCE
F-1
F-2
GREEN
YELLOW
BLUE
STIFF PAPER
TISSUE
F-7
F-8
A
BALSA
STIFF PAPER "FINS"
.029" PIANO WIRE
1" ALUMINUM WHEEL
BOMB RACK
F-6
SUPPORT FOR REAR HOOK
F-13
F-14
F-15


MACHINE GUN
INSTRUMENT PANEL
DETAIL OF PARTS
STIFF PAPER
PIN
F-4
F-5
F-3
F-6
F-3 GREEN YELLOW
F-4
F-5
BLUE
BLACK TISSUE
F-12
F-11
F-10
F-9
A
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ALUMINUM HINGE
SLIT BALSA WITH RAZOR
N
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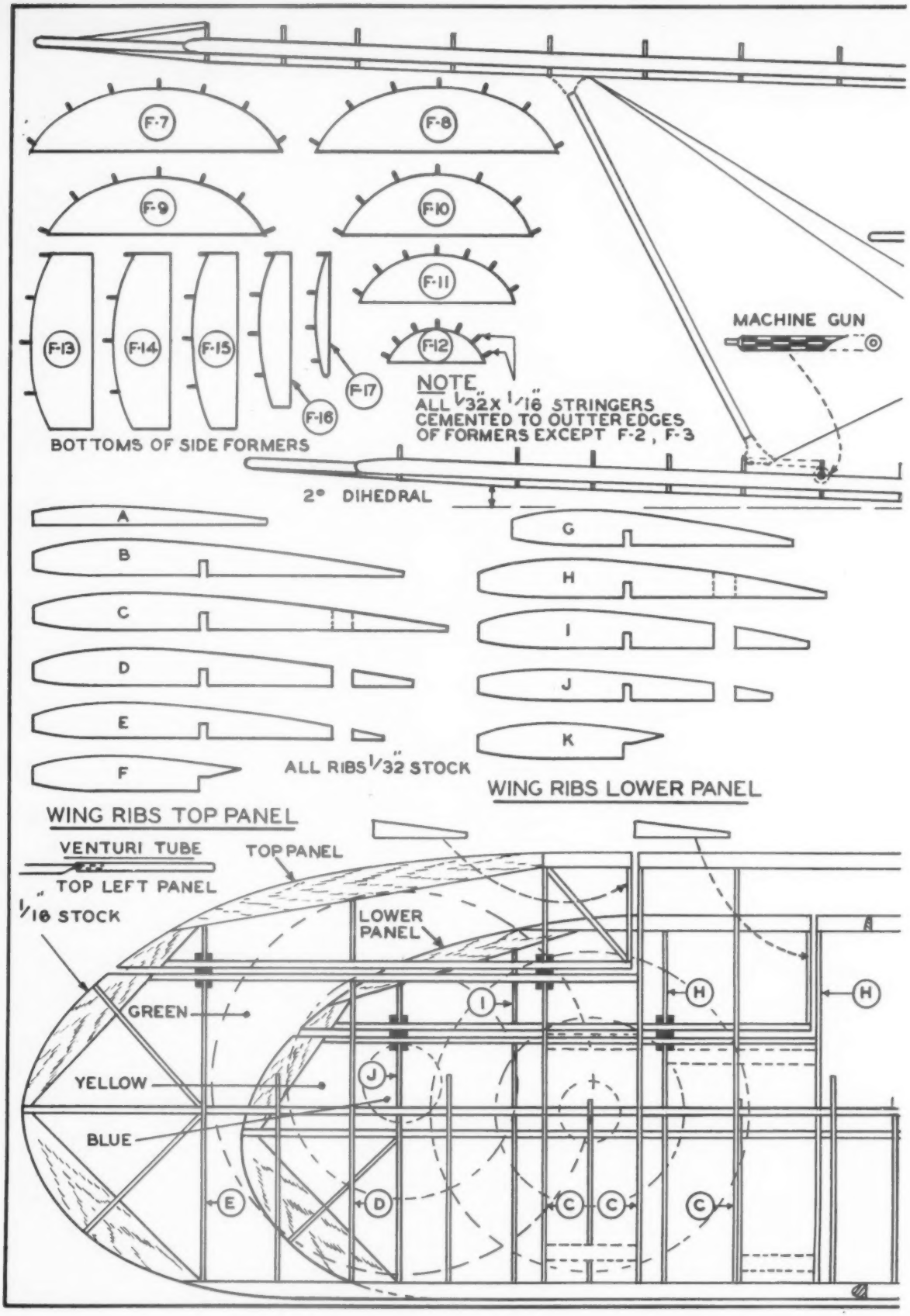
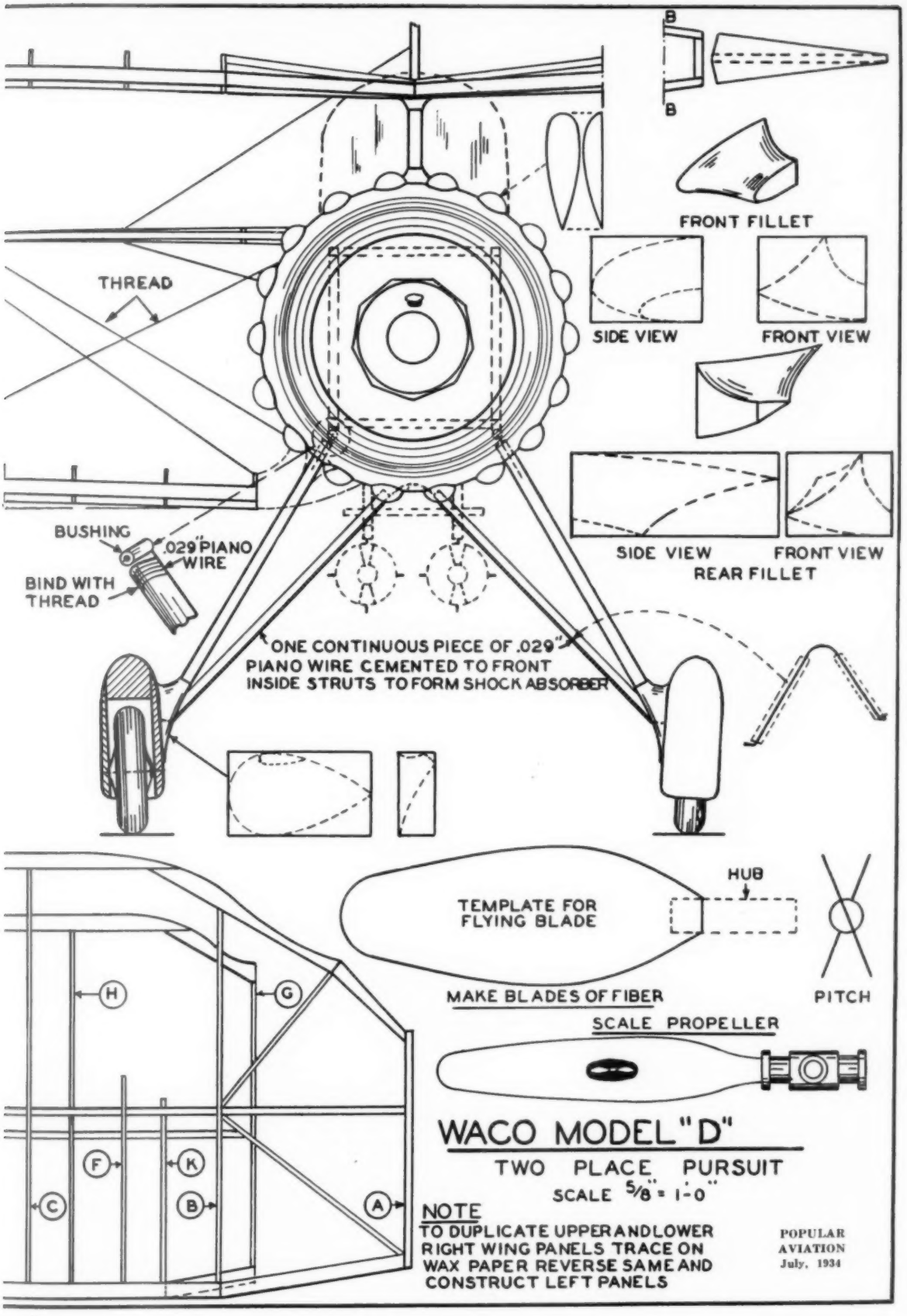
F-16
F-17


F-7
F-8
F-9
F-10
F-11
F-12
F-13
F-14
F-15
F-16
F-17
MACHINE GUN
NOTE
ALL 1/32 X 1/16 STRINGERS CEMENTED TO OUTTER EDGES OF FORMERS EXCEPT F-2, F-3
BOTTOMS OF SIDE FORMERS
2° DIHEDRAL
A
B
C
D
E
F
G
H
I
J
K
ALL RIBS 1/32" STOCK
WING RIBS LOWER PANEL
WING RIBS TOP PANEL
VENTURI TUBE
TOP PANEL
TOP LEFT PANEL
1/16" STOCK
LOWER PANEL
GREEN
YELLOW
BLUE



WACO MODEL "D"

TWO PLACE PURSUIT

SCALE 5/8" = 1'-0"

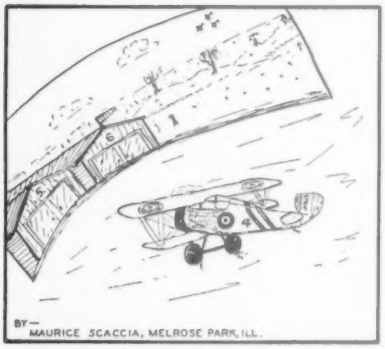
NOTE

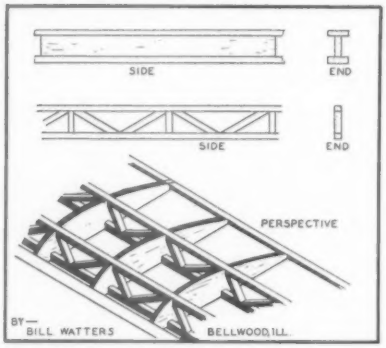
TO DUPLICATE UPPER AND LOWER RIGHT WING PANELS TRACE ON WAX PAPER REVERSE SAME AND CONSTRUCT LEFT PANELS

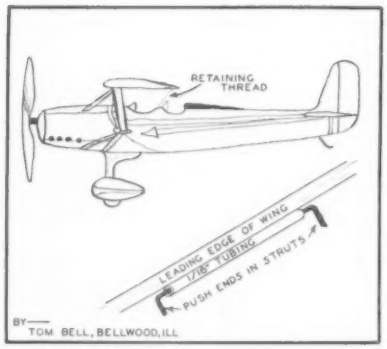
POPULAR AVIATION
July, 1934

New Ideas for Our Model Builders

by JACK KNOBLE







MODEL airplanes look too "modelly," so as to speak, when they are photographed against a blank background, and even more so when they are photographed outdoors.

The whole reason for this "out of scale" appearance is the fact that the model is not to scale with the rest of the landscape and therefore the model loses what might be, a natural appearance. In order that the model look at its best, the background should be the same scale as the model, or in other words, the buildings and trees should be in proportion to the model.

The best scheme is to paint a scene on heavy cardboard as shown above. This scheme was proposed by Maurice Scaccia, Melrose Park, Ill., and his backgrounds have given a highly realistic appearance to his models. The cardboard should be curved slightly as indicated to prevent a flat background.

BILL WATTERS, Bellwood, Ill., has gone into model engineering, to judge from the construction of the wing shown above. In short, Bill shows us a method, or methods, of making a trussed wing spar suitable for a cantilever wing. This method makes a strong light wing structure.

One method of making the spar is indicated by the upper "side-view" where it will be seen that a solid "I" beam is first built up of a thin vertical balsa strip with narrow top and bottom cap pieces. After cementing these pieces together, the diagonal members can be produced by cutting triangular openings as indicated in the lower "side-view."

Another method is to build up the spar by using the narrow top and bottom cap pieces as longerons while the diagonals are short pieces fitted and cemented into place. This is really the simplest and quickest method.

HAVE there been times when you wished that you could adjust the angle of incidence of the wings? Well, Tom Bell, Bellwood, Ill., has devised a means for making this adjustment without taking the model apart or disturbing other parts.

In the first place, the wing is hinged to a pair of vertical struts so that it can swing at the trailing edge. The hinge is made of a $\frac{1}{8}$ inch tube attached to the leading edge of the wing as shown. A stiff wire run through the tube and turned down at the ends forms the hinge pin, and the ends are pushed down into the struts to form the stationary member.

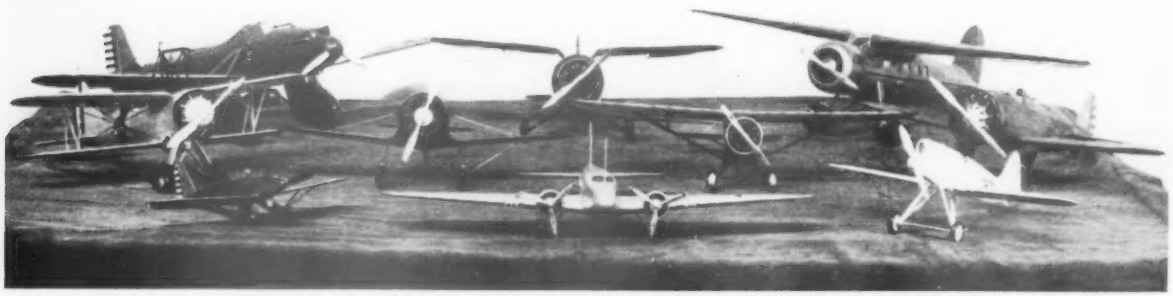
After the hinge has been attached to the struts, the rear edge of the wing is held in place by a thread, and by varying the length of this thread the angle of incidence can be varied easily through a wide range.

The Rymer-Wilson Club Has a Fine Exhibit of Models

WE ARE indebted to Glen Rymer for this photograph of the collection of models built by the Rymer-Wilson Model Club, 129 S. Howard St., Akron, Ohio.

This collection represents several very recent types of U. S. Army Air Corps equipment also a Benny Howard racer and a Boeing 247 transport plane. Wonder if the latter is entered in the P. A. model contest? Annyhoo, the models are very creditable and show a vast amount of painstaking work on the part of the members of this club.

Looming up in the left background is a Curtiss A-8 Attack plane with a smaller edition of the same ship in the left foreground. Then, just to the right of the latter is the front elevation of something that has a strong likeness to a Gee-Bee. The Boeing 247 is in the center foreground while Howard's little pet is the white model at the extreme right hand end of the picture. The large original photograph shows excellent workmanship.



Here is the model exhibit in which many fine modern types of models are shown. The exhibit covers all types of ships produced within recent years.

What the Industry is Doing

News flashes from the aeronautic industry boiled down into a nutshell. Contributions to this department are solicited from manufacturers, schools and airports.

GROVER C. LOENING, pioneer aeronautical engineer, after completing a 150 hour service test on his monoplane amphibian, states that it has particularly good rough air characteristics due to its heavy wing loading. To overcome the high landing speeds induced by this heavy loading, the ship is provided with wing-flaps operated by hydraulic control, which it is said, functioned perfectly during the test. This ship is not yet in production.

A NEW TYPE of advertising banner that takes off the ground horizontally is being flown by the Giro Sales and Service Co., Roosevelt Field, Mineola, N. Y. The pilot can, at will, turn the banner into a vertical position when the desired altitude is reached. This permits getting out of small fields and is easier to handle, and in addition, the banner is provided with a double towrope for safety. The company has applied for patents.

THE NEW Boeing 247-D transport planes will show a number of advanced features over the original 247. They will have geared Wasp engines, and three-blade controllable pitch propellers.

WALTER T. VARNEY, veteran airline operator, has signed a two year contract with the Mexican Postoffice Department for carrying passengers and mail from Tapachuia, Guatemala, via Mexico City and Mazatlan to Los Angeles.

THE ALCOR, the new twin-motored cabin monoplane designed by Allan Lougheed is of unique design. It is powered with two six-cylinder inline air-cooled Menasco engines, 210 h.p. each, which give it a speed of 187 m.p.h. Both engines are within a common cowl. He recently demonstrated the new ship to the U. S. Navy department. The engines are laid opposite to one another with the cylinder heads of the two engines face-to-face. This enables a bullet cowl over both engines, greatly reducing air-resistance.

COL. ROSCOE TURNER, has found that the streamline tires on his Lockheed Express give a better take-off, reduced resistance and a soft landing.

The new trail banner adapted for lightplanes that can be towed successfully by 40 h.p. engines. It is the product of R. V. Trader and Associates.

The General tire, which he is using, has given a good account of itself in many speed events.

NITROA is an upper cylinder lubricant that has many interesting features. It is a fine black powder, so fine that it will pass through chamois skin and yet it is very effective in running-in overhauled motors of all sorts and puts a mirror like finish on cylinder walls, piston rings and valve guides.

ONE of the two Condor transports recently purchased for administration purposes by the U. S. Navy has arrived at the Naval Air Station, Anacostia. The Condor is designed to carry ten passengers, a crew of four and has a cruising radius of over 800 miles. It has a top speed of 190 m.p.h. and a cruising speed of 160 m.p.h.

A SMALL stressed skin wing, designed to be as nearly as possible a reinforced skin rather than a frame wing with a metal covering, is being projected in the engineering drawing and design drafting department of the Boeing School of Aeronautics, Oakland, Calif., for construction and static test purposes. Every effort is being made in the design to develop as nearly as possible, a monocoque structure and at the same time, to develop a method of manufacture that can be applied to small lightplanes.

Here we have James A. Wilson and his Corben Baby Ace. Mr. Wilson has had great success with this ship as may well be judged from his smile. A neat trim job.

AIRPLANE manufacturing plants, airports and other branches of the aviation industry, frequently are faced with the problem of repairing broken concrete floors, concrete aprons and similar concrete repairs. A new material, known as Amolastic, has been prepared for making such repairs. It is produced by the American Oil and Disinfectant Company, 129 East 26th St., New York City.

NEARLY 2,000 airway searchlights, with a minimum illuminating power of one million candlepower each, have been installed on the established airways of the United States by the Department of Commerce, Aeronautics Branch. This work was started nearly ten years ago and has progressed steadily ever since.

PYROIL, the well known lubricant for internal combustion engines, has been put to many strenuous tests during the past year. In one test, Barney Oldfield drove a Pyroil treated tractor at a record speed of 64.28 m.p.h.

BLACK & DECKER Mfg. Company, Towson, Md., have introduced a new streamlined ¼-inch electric drill. The motor power has been increased one-third over previous models and the tool weighs only 5¾ pounds. It has a universal motor for all voltages.

PARKS Engineering students, Parks Air College, East St. Louis, Ill., will soon have a separate building specially designed to meet the needs of the engineering classes. The building is one hundred feet in length and will contain a large drafting room and an engineering class room. The wind-tunnel will be housed in a separate building, a short distance away in which all of the practical engineering work is done.

AN exhibition of Italian aeronautics will be held in the new Palace of Arts, Milan, Italy. It will run from this date until the end of October, 1934. This will be known as the Esposizione Dell'Aeronautica Italiana. The president, Duca Marcello Visconti Modroche, announces that special facilities will be extended for the convenience of Americans who visit the exhibition.

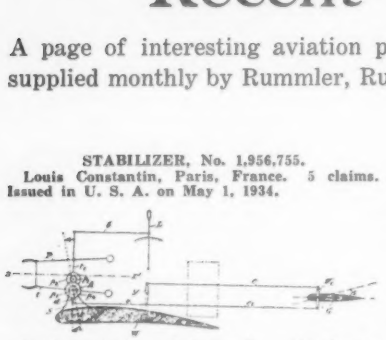
INCREASING numbers of private pilots and owners are "riding the radio beams," according to advice from Bredouw-Hilliard Aeromotive Corporation, Kansas City. This company are selling Westport Aircraft Radios, and are much pleased over the prospects in this line.

A NEW type of aerial tow banner for advertising purposes has been used on lightplanes of 40 h.p., thus opening a new source of income for lightplane owners. It is being produced by R. V. Trader and associates, Dravosburg, Pa.

Recent Patents in Aviation

A page of interesting aviation patents issued by the United States Patent Office. This information is supplied monthly by Rummler, Rummler and Woodworth, Patent Lawyers and Engineers, 7 S. Dearborn St., Chicago, Ill.

STABILIZER, No. 1,956,755.
Louis Constantin, Paris, France. 5 claims. Issued in U. S. A. on May 1, 1934.



In this patent, a wind vane is employed as a stabilizer. The actuating wind vane is connected to the stabilizing surfaces through a system of linkages and gears so that stability is attained automatically. Manual control by the pilot can also be applied when necessary.

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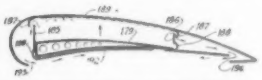
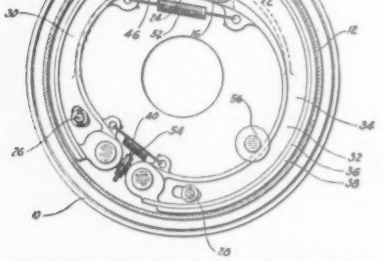
AIR CONTROL, No. 1,957,413.
Albert O. Price, Leesville, Ohio, assignor by mesne attachments to The Priceler Corporation, Cleveland, Ohio. 10 claims. Issued May 1, 1934.



Here we have a reciprocating device which is built into the wings of an airplane. It withdraws air adjacent to one surface and discharges the air adjacent to a second surface at each stroke of the apparatus. By this means, the flow of air and the lifting ability of the wings can be controlled.

• • •

BRAKE, No. 1,957,636.
Frederick C. Frank, South Bend, Ind., assignor to Bendix Aviation Corporation, South Bend, Ind. 7 claims. Issued May 8, 1934.



This is a brake mechanism specially adapted to airplane landing gear brakes. It consists of an anchor, frictional surfaces that engage the anchor and with spaced members connecting the operating shaft to the anchor on opposite sides of the frictional device.

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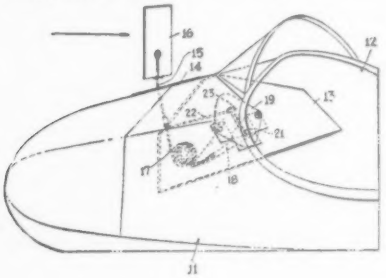
SAFETY METER, No. 1,958,229.
Walter H. Beech, Wichita, Kans., assignor to Curtiss-Wright Airplane Company. 2 claims. Issued May 8, 1934.



In this meter, the impact of the air against a vane moves an indicator on the instrument panel that indicates the airspeed. The vane is mounted on the end of a spring, while the free end of the spring communicates the motion and speed to the indicator.

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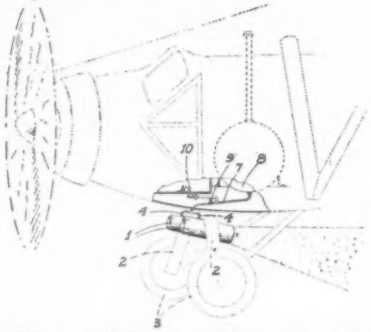
SPRAY DEVICE, No. 1,957,075.
Otto Margensen, Jr., Modesto, Calif., assignor to E. R. Hawk, Modesto, Calif. 3 claims. Issued May 8, 1934.



This is a device for spraying trees, cotton fields, etc., with an insecticide. A venturi tube is mounted in the air-stream with open jets to the rear so that the rush of the air through the venturi draws liquid from the tank and discharges it as spray to the rear and down.

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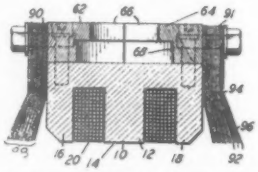
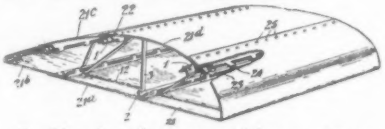
WELDING MAGNET, No. 1,956,841.
George Walmsley, Philadelphia, Pa., assignor to Edward G. Budd Manufacturing Company, Philadelphia, Pa. 7 claims. Issued May 1, 1934.



A device for affecting an adjustable electrical contact with the parts to be welded without the use of screws or clamps. The two flexible copper leaf contacts at the side are held in forcible contact with the welded article by means of an electromagnet. This is applicable only to iron or steel welded parts.

• • •

WING STRUCTURE, No. 1,956,823.
Edmund B. Cairns, Lincoln, Nebr., assignor to Cairns Development Company, Wilmington, Del. 14 claims. Issued May 1, 1934.



In this wing, the upper and lower spars are staggered in relation to one another, connected by diagonal braces. The upper and lower spars are tapered. This is a stressed-skin arrangement in which the outer covering assumes a part of the stress.

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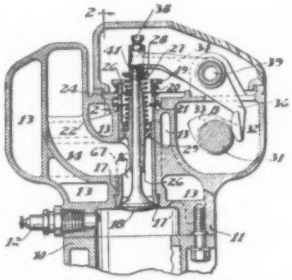
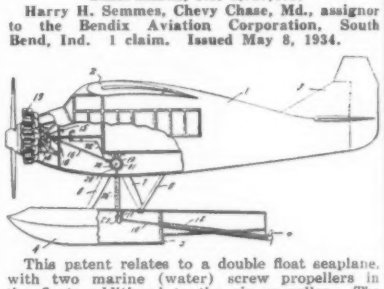
AVIATION ENGINE, No. 1,057,655.
Ludger E. LaBrie, South Bend, Ind., assignor to Bendix Aviation Corporation, South Bend, Ind. Issued May 8, 1934. 6 claims.

A valve system consisting of a poppet valve in a cage, both the valve and cage moving for a portion of the valve travel. This includes a means for separating the valve and the cage and also for returning them to their normally closed position.



SEAPLANE, No. 1,957,675.
Harry H. Semmes, Chevy Chase, Md., assignor to the Bendix Aviation Corporation, South Bend, Ind. 1 claim. Issued May 8, 1934.



This patent relates to a double float seaplane, with two marine (water) screw propellers in the floats additional to the air propeller. The marine propellers are connected through a gear train and differential gear to the main engine maintaining the relative speeds of the propellers. Control is by brakes.

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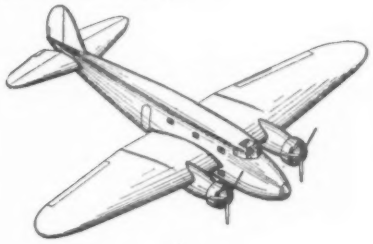
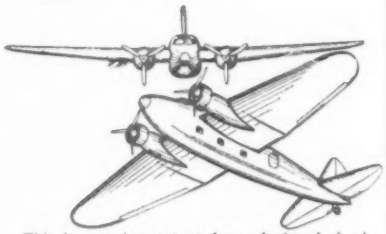
DOUBLE DECK PLANE, No. 92,189.
Robert J. Minshall and Frank R. Canney, Seattle, Wash., assignors to Boeing Airplane Company, Seattle, Wash. Term of patent 7 years. Issued May 8, 1934.





This is a design patent for a double deck airplane of the transport type as shown above. Note that the two cabin spaces are above and below the wing respectively.

EDITOR'S NOTE. Copies of the complete patents can be had by sending 10 cents for each copy to the Commissioner of Patents, U. S. Patent Office, Washington, D. C. Give the patent number and the name of the device and inventor when sending. Rummler, Rumler and Woodworth will also supply you with the patents at the same rate.

Bad Bumps

(Continued from page 33)

able distance, causing a local horizontal wind although the air elsewhere may be perfectly calm. And the pilot, who up to this time has been sailing along serenely in perfectly still air, meets with a great surprise when he runs into a patch of tail wind.

At (1) he is flying with enough speed to barely support the plane, his intention being to make a landing within a short time. Then, upon entering the "down-comer" (B), the air-speed is so suddenly reduced by the tail-wind that he starts dropping at (2) and crashes at (3) before he has had an opportunity to make corrections. The circulation stream is 15 m.p.h. (from behind), hence the air-speed of the wings in this case is suddenly reduced to 25 m.p.h.—'way below the landing speed of this particular plane.

As this air circulation exists only over a comparatively small area, it does not affect the wind-socks on the hangars, hence the pilot receives no warning prior to the big bump. With the wind-socks hanging motionless on their masts in perfectly calm air, the pilot or student can hardly be blamed for the catastrophe.

A third source of trouble, although they are rare, are the small whirlwinds or "dust witches" shown by Fig. 3. As a matter of fact, they are vest-pocket tornadoes consisting of a whirling mass of air with a considerably reduced air-density within the rotating air. Air is drawn into the cone from below and discharged at the top, causing a cloud of dust over dry bare ground, but it is otherwise invisible.

Now, if a plane enters from the left as at (1), and enters the whirlwind, the decreased density of the air, together with the down-coming air from the top of the cone, will cause the ship to drop suddenly and crash as at (2). The author saw a crash of this sort take place, which was fortunately without injury to the pilot. The whirlwind had been progressing across the field at a speed of about 15 m.p.h., kicking up a considerable cloud of dust until—just as bad luck would have it—it cleared up and became invisible to the pilot as he started shooting for the field. The plane dropped like a plummet for a good 20 feet and described several ground loops, notwithstanding the fact that the landing gear had been washed out by the initial impact.

The whirlwind proper probably did not cover a zone exceeding 50 feet in diameter but its influence covered an area many times greater than the dust zone. At any rate, it was fully sufficient for its purpose and very effectively kicked out all support beneath the plane. END.

America Welcomes The IMPROVED AERONCA

- *Airwheels*
- *Oleo Landing Gear*
- *Dual controls*
- *Side-by-side cockpit*
- *Real visibility*
- *77 m.p.h. cruise*
- *93 m.p.h. top*
- *28 miles per gallon*
- *Extra-saftey construction thruout*

WITH the improved reliable Aeronca engine it cruises faster, farther and more economically. New low-drag landing gear, advanced streamlining, improved wing design offer better appearance, more speed, cheaper operation to private owners, flying schools and commercial operators.

Aeronca's famous ruggedness, hands-off stability, and dependability have not been changed. Aeronca is unchallenged under $2,000 for completely satisfactory commercial, instruction or pleasure flying.

Write for interesting new booklet, "Flying In Its Safest and Most Economical Form."

AERONAUTICAL CORPORATION OF AMERICA
LUNKEN AIRPORT AERONCA CINCINNATI, OHIO

EXCLUSIVE AGENT FOR THE TRIANGLE PARACHUTE
MANUFACTURED AT CINCINNATI, OHIO

Takes off like a rocket...

holds its course like a liner...

lands like a feather

That's the WACO *Model F-3*

New beauty and gracefulness are added by the rounded fuselage and the more complete fairing, which has been extended to include the lower wing roots.

•

If you are experienced, then all we have to tell you about this ship is that it's a three-place, open-cockpit model—and that it's built by WACO.

But if you're just beginning to take up flying in a serious way, it might not be amiss to inform you that WACO has earned a reputation for building ships that do things as only a WACO can do them.

And this Model F-3 is even more startling in performance than any similar models of the past. Here are higher top speeds and cruising speeds. Here are countless touches of refinement and longer, wider cockpits to add to your comfort and convenience. Here are major improvements that you will surely want on the ship *you* fly.

And how this trim, new WACO zooms up in typical WACO fashion for a quick take-off! How steady it is in flight! How lightly and surely it settles down in the smallest field! How amazingly easy it is to handle!

Two power plants are available... the Continental 210 H. P. radial—and the Jacobs 225 H. P. radial. The Jacobs can be had either with the conventional dual Scintilla Magneto or with Bosch dual battery ignition, which includes a generator.

But let us send you complete information. Or, better still, we suggest that you arrange to take a flight with our local dealer. It will not obligate you in any way. If you do not know his name, write us.

THE WACO AIRCRAFT COMPANY
TROY, OHIO

WACO AIRPLANES
"Ask Any Pilot"

WACO LEADS IN AIRCRAFT REGISTRATION

U. S. Navy

(*Continued from page 26*)

extent where it cannot too definitely assert its true value.

On June 31, 1933 the Navy had 957 useful airplanes in service, undergoing overhaul, or in storage, of which 25 percent. were training planes. At the same time there were 826 officers and 337 enlisted men who were qualified pilots, a total of 1,163 naval pilots. This figure shows that we had 206 more pilots that were not provided with planes and that if we were to put all our Navy planes in the air at once, 25 percent. of the pilots in the air would be flying training planes. It is estimated that if we were to gather together all the planes of the Navy and the Army that we would actually have no more than 600 planes of any decent service quality according to 1934 standards.

With Congress blundering right and left in our military aviation policy and those high in command in the Navy seeking to keep Naval Aviation from expanding, it is not surprising that some of the practices of the Navy in regard to the personnel in the Naval Air Service are comical and at the same time tragic.

For instance, a Navy flyer, before he can be promoted to the next higher rank must serve about two years at sea on a cruiser before he is eligible. If I may quote a well-known news commentator, this seems "about as logical as telling an Army Air Corps pilot to go down to Fort Mills and fork a horse for two years before he can be promoted in the Air Corps." As an example of this bit of Naval burlesque, Rosendahl and Reichilderfer are being returned to the lighter-than-air organization of the Navy this summer after nearly two years of sea duty. And these two men are two of the most experienced and well informed airship men the Navy has.

Under the Vinson-Trammel bill $932,000,000 dollars has been authorized for the building of naval warships, ships by the way which airplane bombs dropping anywhere within one hundred yards of them can sink. Mr. Vinson requested that sufficient aircraft be supplied these ships to protect them, so the Navy has had its quota of 1,000 serviceable planes raised to 2,184. These planes are to be supplied at the rate of approximately 169 per year. Figure out for yourself how long it will take to get from the present 957 planes to 2,184 at that rate, and also how old the planes we now have will be when the limit has been reached.

During the discussion on the floor of the House while the $932,000,000 was being appropriated for naval vessel construction, one of the most intelligent remarks ever made among that group of stolid legislators was made by Representative O'Mally, viz., "Does it not seem rather contradictory to spend millions of dollars to build immense ships when we have to put airplanes on board to keep them from being destroyed by airplanes?" Needless to say his remark caused a bit of amusement but that was all.

The majority of our congressmen will need a few airplane bombs exploding about their ears before they will get the fact through their heads that the airplane is one of the most powerful and deciding factors in modern scientific warfare and that they are still thinking along Spanish-American War ideas.

President Roosevelt has appointed a commission to investigate our branches of aviation with a view toward increasing their efficiency. Frankly, though, one is inclined to be a bit skeptical. Since the World War there have been more than twenty-five separate investigations, all of which were trying to determine a sound policy for our air forces, especially as related to National Defense.

Today, the total result is that our air forces are still weakened and hampered by their division as branches under other services, they are equipped with nothing more than junk in com-

(*Concluded on page 48*)

TABLE III

COMPARISON NO. 2

U. S. NAVY FIGHTERS ATTACKING FOREIGN NAVY WARPLANES

GROUP A: U. S. NAVY FIGHTERS—SINGLE-PLACE AND MULTIPLACE

Country	Type of Warplane	Max. Speed in m.p.h. at 15,000 ft.	Crew	No. of guns	War-Service ceiling in ft.	Remarks
U. S. A.	Boeing F4B-4	185	1	2	27,500	
	Curtiss "Goshawk"	180	1	2	25,400	
	Curtiss "Sparrowhawk" F9C-2	163	1	2	21,700	"Macon" defender.
	Berliner-Joyce FXJ-2	180	1	2	24,700	
	Vought V-70	160	2	3	22,300	
	Curtiss "Helldiver" F8C-7	160	2	3	22,000	U. S. Marine Corps

GROUP B: FOREIGN NAVY FIGHTERS, SINGLE-PLACE
(Superior in speed and ceiling to all U. S. Navy fighters)

Great Britain	Hawker "Nimrod"	210	1	2	35,000	Fastest navy fighter in world
	Hawker "Hoopoe"	205	1	2	33,000	
	Fairey "Firefly III"	205	1	2	33,000	
Japan	Hawker "Nimrod"	205	1	2	33,000	Licensed from Great Britain
	Nakajima 90	200	1	2	32,000	

GROUP C: FOREIGN NAVY FIGHTERS, MULTIPLACE
(Superior in speed and ceiling to all U. S. Navy fighters)

Great Britain Japan	Hawker "Osprey"	200	2	3	32,000	
	Licensed to build Hawker, Junkers and Dornier planes					

GROUP D: FOREIGN NAVY OBSERVATION, LAND PLANES—CARRIER PLANES
(No protection required—out of reach of all U. S. Navy fighters)

Great Britain	Hawker "Osprey"	195	2	3	32,000	
	Short "Gurnard"	185	2	3	30,000	
Japan	Licensed to build Hawker, Short, Junkers and Dornier					

GROUP E: FOREIGN NAVY PATROL FLYING BOATS
(No protection needed owing to superior defensive armament with tail gun station)

Country	Type of Warplane	Max. Speed at 10,000 ft.	Crew	Tail guns	No. of gun stations	War-Service ceiling
Great Britain	Short "Singapore II"	150	7	1	4	16,000
	Short "Rochester"	145	10	1	4	15,000
	Supermarine "Southampton X"	125	7	1	4	15,000
	Blackburn "Iris V"	120	5	1	3	15,000
Japan	Navy 90-1 (Navy Yard)	130	6	1	4	15,000
	Navy 90-2 (Kawamishi)	125	7	1	4	15,000

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These little replica models are exact reproductions of large airplanes and are correctly lacquered and rigged. Wing spreads range from 3" to 7". Special this month: Curtiss "Goshawk," 5½" W. S., lacquered Navy colors for only $1.00 P. P. Any other model you desire can be had for $1.25 P. P. Canadian and Foreign, 30% extra. All built of pine wood. Glossy finish guaranteed. Please, no COD orders.

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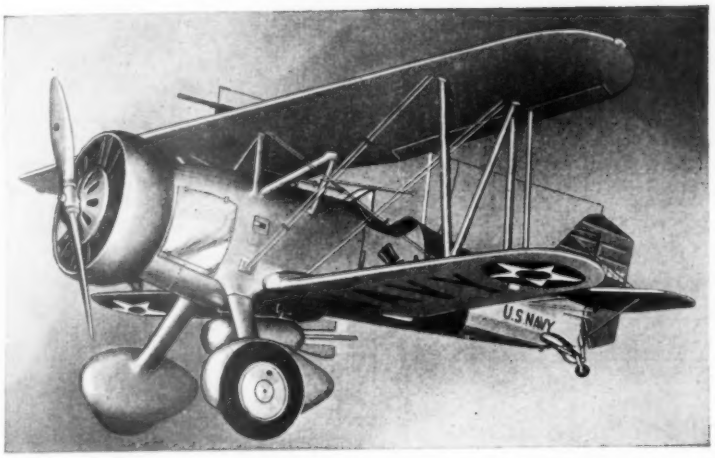

Actual Photograph of the Ideal "SuperDetail" Curtiss "Goshawk" Fighter Wing Span, 23⅜ in. Length, 16¾ in. Weight, 3⅜ oz.

THESE are the newest and most advanced development in Model Engineering. Nothing like them has ever been designed before. FIRST: they are accurate, scale reproductions; every constructional and detail feature of the original ships has been copied accurately and completely! SECOND: these models have fittings and equipment never before attempted on any model; parts which actually work! THIRD: these are both exhibition and flying models; their beautiful appearance and true detail will win the admiration of any expert, and we guarantee them to fly.

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Curtiss "Goshawk" Fighter

"Close-up" view of the cockpit of the "Goshawk" showing the Control Stick, Foot Pedals and Pilot's seat. These controls operate the Ailerons, Rudder and Elevator just as they do on the real airplane. This model has everything; even the radio aerial and camera gun mounted on top wing!

BUILD this snappy Curtiss F11C-2 shipboard fighter with our "SuperDetail" kit and you'll have the finest model airplane you ever saw! Every little detail of the original ship is duplicated in this model, in exact scale. All the details you see in the photo above are included, and many more you cannot see! The kit contains an aluminum drag ring specially designed in true scale; two detachable-blade propellers, one for exhibition and another for flying; exact scale, wood wheels with streamline fairings; and the entire model coated with the new IDEAL High Lustre Finish, with silver, yellow, red and black coloring. The kit is the most complete we ever put out; contains big, full-size plan showing every stick and its place in the model. Plenty of material is furnished, and all of it ready for use with very little work. The complete kit to build this "Goshawk" model, with all the fine details as shown above, sent to you fully prepaid **$2.00**

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Designed specially for Model Builders; cuts balsa, cardboard, paper, etc., quicker and easier, and holds an edge longer than any razor blade. 7¼ in. long, with penholder handle. Razor-sharp, spring steel blade with protector. Blade can be resharpened repeatedly. Only 10c. If ordered alone, 3c extra for postage. Postage free when ordered with other items.

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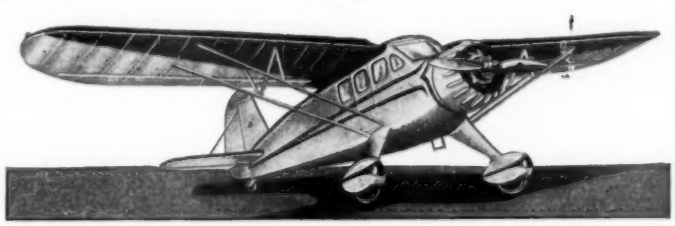

Actual Photograph of the Ideal "SuperDetail" Stinson Reliant Airliner Wing Span, 32⅛ in. Length, 21½ in. Weight, 2¼ oz.

Stinson Reliant Airliner

WHAT a model! Beautiful, clean-cut lines exactly like its popular original. You will be proud of this model in any company. Ailerons, Rudder and Elevator can be set in any position desired for flying, and controlled by cables from cabin. Entire model designed in exact ¾-inch scale, every detail accurate and with weights shifted for flying to compensate for differences in the center of gravity. Kit contains big, 34"x44" plan, showing every operation. Every stick and fitting needed in building is included, and many special parts designed for these "SuperDetail" Models. If the very latest ideas in model engineering interest you, this is the model you should build next. It will make a real hit in any company, with its glistening yellow and black colorings, and "SuperDetail" features not obtainable in any other models. Complete kit to build this beautiful model, with all the detailed features, sent you fully prepaid for only..... **$2.50**

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U. S. Navy

(*Continued from page* 46)

parison to what other nations have, the pilots are limited ridiculously in their flying time and all the air services must be the butt of any fanciful ideas, whims, jealousies and prejudices that the land generals and the sea admirals have.

And there is another point that I wish to make in regard to our present inferiority in respect to airplane performance. That is to condemn the present practice of purchasing planes for the army or navy on a price basis. This has completely discouraged the smaller airplane builders and minor designers for the reason that, under present conditions, it is impossible for them to develop new types of planes.

Every naval or army plane is largely an experimental job and carries heavy experimental development charges. Only a few planes are put into production at any one time of any particular type so that each plane sold to the government carries a heavy experimental charge. And I claim, therefore, that airplane builders must be granted subsidies, or at least a fair price, for new developments. No private plant can bear this expense alone, and this is reflected in the poor showing made by our planes.

Truly, we have government bureaus appointed for the task of carrying on experimental work, such as the Advisory Committee on Aeronautics, but this relatively academic experimentation does not take the place of full scale trial and tests by a manufacturer. A subsidy seems to be about the only solution.

I repeat, I'm hopeful, but I'm skeptical to the point of desperation that anything can be done to eradicate the overwhelming ignorance and prejudice in those responsible for our aerial defense. END.

TABLE IV

LEADING NAVAL WARPLANES COMPARED TO THEIR ACTUAL SPEEDS AT WAR-SERVICE ALTITUDES

NAVY FIGHTERS, PURSUIT, SINGLE-PLACE—WAR-SERVICE ALTITUDE 15,000 to 20,000 ft.

Position	Country	Type	Speed m.p.h.	U. S. Deficiency in Speed at War-Service Altitude	
				Measured in m.p.h.	Measured in percent
1	Great Britain	Hawker "Nimrod"	210		
2	Japan	Hawker "Nimrod" (licensed from Great Britain)	205		
3	U. S. A.	Boeing F4B-4	175		
		Curtiss "Goshawk" F11C-2	175	—35 m.p.h.	—16.67%

NAVY FIGHTERS, MULTIPLACE—WAR-SERVICE ALTITUDE 15,000 to 20,000 ft.

1	Great Britain	Hawker "Osprey"	195		
2	Japan	(Licensed to build Hawker, Junkers and Dornier planes.)			
3	U. S. A.	Vought V-70	160	—35 m.p.h.	—17.95%

NAVY OBSERVATION, LAND PLANES—CARRIER PLANES, WAR-SERVICE ALTITUDE 15,000 ft.

1	Great Britain	Hawker "Osprey"	195		
2	Japan	Licensed to build Hawker, Short, Junkers & Dornier.			
3	U. S. A.	Vought V-50	160	—35 m.p.h.	—17.95%

NAVY TORPEDO-BOMBERS, LAND PLANES—CARRIER PLANES, WAR-SERVICE ALTITUDE 10,000 ft.

1	Great Britain	Blackburn "Ripon" M. 1/30	150		
2	France	Latecoere 29	140		
3	Japan	Navy 89 (Licensed to build Hawker and Blackburn planes.)	135		
4	U. S. A.	Martin MB-2	125	—25 m.p.h.	—16.67%

NAVY PATROL FLYING BOATS—WAR-SERVICE ALTITUDE 10,000 ft.

1	Great Britain	Short "Singapore II"	150		
2	Italy	Savoia-Marchetti S-55	135		
2	Holland	Dornier "Wal"	135		
3	Japan	Navy 90-1 (Licensed to build Short, Blackburn & Dornier planes.)	130		
4	France	C. A. M. S. 55-3	125		
5	U. S. A.	Martin XP2M-1	120	—30 m.p.h.	—20.00%

Thin Air

(*Continued from page* 12)

lead dust or small shot with them into the skies for ballast. Most of it will be discharged as they ascend, through an airlock in the shell near the gondola's bottom. About 2,500 pounds will be retained as landing ballast. Batteries, radio equipment, oxygen tanks and hatchcovers will be used as additional ballast, to be thrown out before landing. A partly inflated pneumatic bumper on the base of the gondola is expected to help.

Readings are to be made, with the bag fairly stationary, with the hatchcovers removed at a height of about 20,000 feet. Then the hatches will be hermetically sealed for the venture into the low-pressure region. Readings, however, will continue to be made regularly as the balloon rises to its maximum, and these readings will be checked in the descent.

Some of the information the flyers hope to bring back with them is: electrical condition of the atmosphere after 5,000 feet; cosmic ray intensity, penetration and direction of movement at various heights; wind direction and velocity; measurement of solar radiation; photography of the solar spectrum; record of sky brightness; effects of altitude on radio transmission; oblique photography for distance, and balloon navigation problems, especially the effect of the "superheat" described above, absorbed by the bag from the sun's rays.

"What the future holds in the way of higher stratospheric penetration," says Maj. Kepner, "no one knows. I hope that our flight, and the second one we plan for September, may pave the way for higher ones. Sure, I think it a great adventure. I feel a little like Jules Verne, living in a modern age, and like Buck Rogers come to life before his time." END.

Monocoupe

(*Continued from page* 18)

tire and employing a shock-cord shock absorber is used.

Two of the outstanding features of the ship are its remarkable speed range and economy of operation. This is made possible by extreme cleanness in design giving a top speed of 165 miles per hour, a cruising speed of 140 miles per hour and landing speed of 50 miles per hour. At cruising speed, with the motor turning 1,925 r.p.m., the fuel consumption is between 8.0 and 8.5 gallons per hour which gives approximately 17 miles per gallon.

Standard equipment includes the usual instruments (Turn and Bank and Rate-of-Climb extra), electric starter, battery, steel propeller, wheel-pants, steerable tail-wheel, parking-brakes, dual controls and brakes and radio bonding.

END.

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IF you expect to run out of material before the model is finished—for you'll be disappointed; or if you expect to have to consult a fortune-teller to solve the mysteries of incomplete instructions—for again you'll be disappointed; or if you expect to see your finished work look like something the cat dragged in—for once more you'll be disappointed; or finally, if you expect to have the model fold up into splinters on its maiden flight, for, yes, we must admit you're due for another disappointment. **BUT**, if you want to be sure of **getting everything you expect** when you spend your money, **THEN** by all means **get** a Cleveland-Designed model! Expert modelbuilders say:

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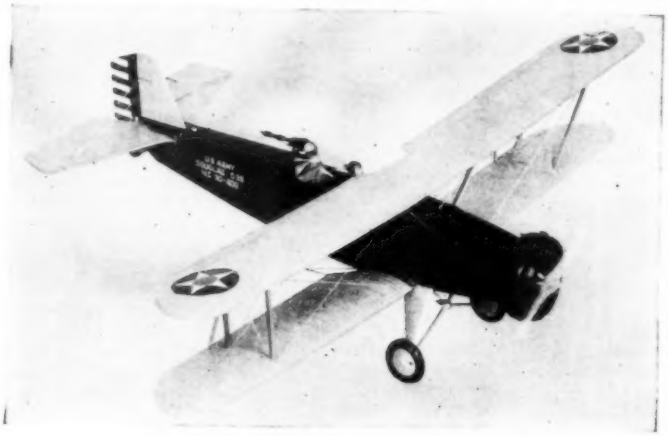
Excellent performing high speed model. Span 23⅝", length 17⅝", weight 3.5 oz. Colored silver, with red-white-blue insignia. Authentic and superdetailed. A Super-complete Kit—211 pieces, including the printed out wood parts, all supplies, special equipment, dopes and the famous C-D exact size superdetailed drawings. **Complete Kit SF-44**, postfree, only **$1.75**



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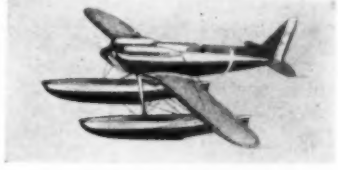

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The "Bullet"

(*Continued from page 22*)

and must have caught fire immediately, the left wing lying practically intact a few yards away. The condition of the radiator and the landing gear showed that the plane, when it struck, was perfectly level laterally and heading up longitudinally.

The radius of the turn could not have been more than 300 feet which would have produced a dynamic factor of 8, whereas in the quarter mile turn originally figured on the dynamic factor would have been 2. Although the flexible wing would have washed out much of the strain, this effect would have been partially vitiated by excessive application of the aileron control. It is, therefore, not improbable that the wing was strained to the utmost by the sharp turn, and that the strains were aggravated by the pilot's evident attempt to zoom into the small clearing and out of it.

The speed of the plane was too great for this maneuver, which was totally uncalled for, and the Bullet struck the tree about 25 feet from the ground. It is possible that the wing ripped loose just as he was putting the plane into the upward room.

Whatever may have been the immediate cause, the fact remains that the accident was primarily due to the pilot exceeding his instructions. Our examination of the salvaged wings revealed that the fracture of one of the steel reinforcements had a bright main fracture from the lower screw hole up, and a discolored, apparently older fracture from the lower screw hole down, a distance of about ½ inch. This suggests the existence of a crack prior to the fracturing of the steel strip.

Considering that the reinforcing strips were made of exceedingly hard saw-steel, it is not unlikely that this crack was started during the process of drilling and countersinking the screw holes. The accident gave rise to a storm of criticism which would have caused any other man to throw up the sponge right then and there. Not so Doctor Christmas. He knew that his ideas were fundamentally sound and embodied the results of many years of patient observation, research and experimenting. So another Bullet was built, the wing spars of which were endowed with an excessive factor of safety which naturally detracted much from their flexibility.

This ship was tried out in April, 1919, and all went well until the pilot took a notion to put the plane into a steep dive and zoom. The terrific speed which was attained during this maneuver caused the wing covering to be torn from the wing frames, with fatal results, and be it noted in passing, mishaps of an exactly similar nature have occurred in several other makes of ships before and since.

This started another fierce outbreak of rabies in the aviation industry which made one wonder why all this precious emotion should be lavished and concentrated on the only ship in the history of aviation that could show a truly economical performance in the matter of climb and speed for the horsepower expended. Even at this present day, there is no record of any other ship ever attaining the speed of 190 m.p.h. with only 175 h.p. and detractors of the Christmas Bullet would do well to keep this fact in mind.

Doctor William Whitney Christmas was born in Warrenton, North Carolina, on September 1, 1865. After graduating as a Doctor of Medicine from the University of Virginia, his special knowledge of anatomy facilitated the research work to which he began to devote himself in 1890 in which year he started his systematic observations of bird flight. His methods were rather original. After providing a suitable bait for the buzzards abounding in his locality, he would lie in hiding for hours at a time near the spot where the birds were feeding.

He soon found that the flexibility of the bird's wings played a most important part in its flight performance and he expected this to be the main reason for its astonishing soaring power. His observations showed that the inherent flexibility and resilience of the wing enabled it to automatically wash out any strain caused by airloads in excess of those required for actual sustentation.

The spontaneous flexing action, moreover, relieved the wing structure from sudden shocks, this suggesting the probability that a flying machine provided with flexible wings would show a smoother progress than one having rigid wings. This as actual flight tests have since demonstrated, is indeed the case. The automatic washing out of the wing modifies the camber. The general effect being equivalent to decreasing the wing area.

Another important feature was also observed, namely the "sculling" effect of the flight-feathers, which being kept in constant, although often hardly perceptible, vibratory motion by the air currents, seemed to drive the bird forward in a level flight path, thus disclosing the existence of a forwardly acting force. When the wings are tilted at a high angle of incidence this force would then naturally act upward, to which may be ascribed the slow landing speed of the bird.

The existence of this propelling force was confirmed by an interesting experiment made by Doctor Christmas. He fed a bird in captivity the usual amount of food, the energy contained in which was determined by the heat method. He discovered that even if all this energy was expended in the work of flying alone without discounting such energy required for the maintenance of the body, it would hardly suffice to sustain the bird in the air even for a very short time.

This experiment made it clear that the existence of agencies other than mere muscular exertion had to be conceded in order to make extended flight possible, and that these agencies could perforce be none other than the reactions of the eddying and billowing air currents upon a suitable recipient such as the resiliently flexible flight-feathers whereby upward acting forces were converted into propelling forces.

The soaring bird thus derives sustentation as well as propulsion from his motionless out-stretched wings, independently of the energy derived from the food, the manipulation of the wing being a matter of the subjective sense of the bird, much as is the case in a man walking, the members responding to the will in an instinctive and automatic manner.

It was also found that the bird's wing, in contrast to artificial airfoils, is one hundred percent efficient, since the shingled or overlapping arrangement of the feathers prevents the formation of a dead-air film whereby the effective profile of a wing is often considerably modified and the lifting power correspondingly lowered, the decrease being often as much as from 13 to 17 percent.

He also discovered another feature which greatly contributed to the efficiency of the bird's wing, namely the electric charge carried by the wing, this charge being of the same sign as that of the surrounding air. The air is thereby prevented from clinging to the feathers, the repulsion between the air and the feathers being sufficient to obviate skin friction and to prevent the interstices between the barbs of the feathers from being clogged up by the clinging air. The porosity of the feathers is thus preserved. This porosity, he found, played an important role in flapping flight and produced an effect akin to that of the slotted wing.

By way of elucidation, we would draw attention to the fact that the bird's mode of respiration differs from that of the mammals in that the air is not inhaled and expelled bellows-fashion, but is, by means of airsacks, drawn completely through the lungs. Inasmuch as the hollow bones of the bird's wing communicate with the lung cavity by minute passages, the wings partake of the same electric charge as the lungs, which in the bird by reason of its peculiar mode of breathing does not change its sign from positive to negative in accordance with inhalation and exhalation as it does in mammals.

This subject belongs to the realm of physiology rather than aerodynamics and it took a doctor of medicine, like Dr. Christmas, to make this discovery which has since been satisfactorily vin-

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dicated. Those who are really interested in this subject might read up in Hankin's "Animal Flight" about the "soarability" of the air, when soaring birds, no matter how good the air conditions may be otherwise, refuse to take off, and if they do, can then only progress by laborious flapping flight.

In view of Dr. Christmas' discovery it is safe to assume that on those occasions the air does not carry a homogeneous charge of electricity, the alternating positive and negative currents causing the formation of an air film whereby flight is hindered.

It took Dr. Christmas many years of patient research to make these discoveries which were received with scant attention and often with derision on the part of the less well-informed. The value of his work and the correctness of his conclusions are now well recognized. It should not be forgotten that one of his many inventions dating from 1905, namely the aileron, has been in universal use practically since the inception of aviation and that without this device aeronautical development would not have been possible.

Doctor Christmas is pre-eminently a pioneer, in aviation as well as in other fields, and was the first man to fly a motored plane after the Wright Brothers, in Fairfax County, Va., from March 1st to 8th, 1908. This plane was the first to be provided with inset ailerons.

For many years past Dr. Christmas has been engaged on the development of a "flying-wing" plane, his first design of this type of craft appearing as early as 1916. His latest design, which has met with the approval of the best authorities both here and in Europe, shows the same clean lines for which all his conceptions are remarkable.

The writer of this article who has the privilege of being intimately acquainted with the Doctor, is qualified to say, through personal investigation and verification, that if Doctor Christmas had been accorded the proper cooperation and support in the matter of the Bullet from those authorities that were in a position to do so, this type of ship would long since have been developed and adopted for commercial use and would have superseded the antiquated designs which persist unto the present day.

It is one of the surprising inconsistencies of aeronautical development in this country that a plane like the Christmas Bullet, after demonstrating its undoubted merit and enormous possibilities, should have been deliberately discriminated against in favor of exotic designs and products, leaving the work of further investigation to more open-minded and less prejudiced countries.

Times have changed since the flights of the Christmas Bullet, and the powers that were have evolved into the powers that be. What of them?

END.

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4 "	25c	4 "	30c
4½"	25c	4½"	40c
5 "	30c	5 "	45c
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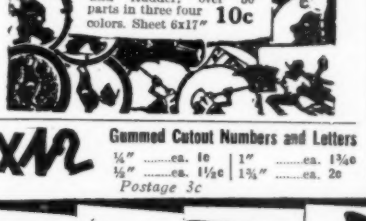

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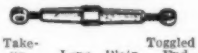

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1/16x1/32	23	5c	3/32x2	4½c
1/16x⅛	16	5c	3/32x3	6c
3/32x3/32	10	5c	3/32x6	12c
3/32x⅛	10	5c	⅛x2	5c
⅛x⅛	10	5c	⅛x3	7c
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Airy Chat

(*Continued from page 4*)

used in the past, are too difficult to handle. What we need is a more effective student socker.

* * *

ABOUT a month ago, I received a criticism from a reader. Mebbe he's right. He claims that the Airy Chat is not a "chat" at all, but simply a one-way monologue. Perhaps the monologue gives him a pain—but what to do about it?

* * *

PARDON, Messieurs, I mislaid about two armfuls of dinkys this month, hence we are dinkyless for this time. They are not lost—only mislaid. This will make the proud authors sore but it will probably tickle the rest of our readers pink.

* * *

QUESTION: What great 'round-the-world flyer, on his first flight, thought he was carrying a navigator when he suddenly discovered that he was only carrying a passenger? Wotta man!

* * *

THERE are at least 22 inventors of two-cycle lightplane engines. We received this many replies after the publication of "lightplane engines wanted" in a past Airy Chat. A few of them are patented, some are still in a nebulous state but none of them have ever been built. And all of them, of course, would be world beaters—if the inventors only had enough money to build them.

But this does not answer the question asked in the Airy Chat. What we were trying to locate is a good 50 h.p. engine that has been tested, built and is ready for production. And the engine that we want must not cost more than $200 at the outside.

* * *

ROCKETS are taking the country by storm. There is a tremendous amount of private experimental work going on along this line. I cannot help feeling, therefore, that it will not be long before we hear of some really long distance rocket flights. Up in the thin air, above 20,000 feet, the rocket comes into its own as a highly efficient motor without vibration or mechanical complications.

* * *

EVERYBODY is sitting smug and contented this summer on the subject of the lightning hazard. A scientist has demonstrated, according to his own light, that a stroke of lightning will not endanger an all-metal plane. It is claimed that lightning struck a British plane without causing trouble and that only a few burned spots were left as evidence.

Now, while I believe that the lightning struck close to the plane, causing burns by induction, I'm quite certain that neither the main stroke nor any of the branches struck the plane directly. A sudden rush of 500,000 to 1,000,000 amperes would most certainly fuse the thin skin metal of any plane—bonded or not bonded.

* * *

WE have an object of historical interest in our office. It is a scrap of cloth from the first aileron ever constructed. It came from an experimental plane built by Dr. Christmas.

* * *

CHICAGO, long a hotbed of bad politics, can naturally be expected to propose an ultra-asinine airport project. The only notable thing about this proposed airport is the fact that it is worse than the present airport and will cost about ten times as much. In our next issue we hope to give you a picture of the latest airport monstrosity developed by a combination of ward politics and unscrupulous advisers.

* * *

SOME time ago, I made the remark that true stories of aero battles during the World War must be running toward an end, and from this time on, such stories of aerial duels must be fiction unless we started all over from the beginning and repeated the yarns. This statement aroused the ire of some of our readers who believe, evidently, that an infinite number of aerial battles were fought during the 15 months that we were in the war.

Now, just let us figure about how many war ace stories have been written since the war. During the 15 years that have elapsed, the magazines averaged 60 stories per month or 720 air-battles per year. In 15 years, not far from 12,700 stories of dog-fights have been published, which is plenty of dog-fights in a manner of speaking,—even in the form of stories.

In order to get material for 12,700 aerial battles in 15 months, the American air force would have fought 720 such battles per month or 24 battles per day. This, you know, is ridiculous.

* * *

FLOYD KOWALAKE, first prize winner in the recent POPULAR AVIATION model contest, has received an offer for the winning model. He replied to the prospective purchaser as follows:

"In reply to your letter concerning the sale of my model Boeing. The model is for sale and the price is five hundred ($500) dollars.

"This may seem high, but when you consider the 1,000 hours of hard work put in building the model, and many more hours of work making molds, dies, corrugating and riveting machines, also collecting data on propellers, engines, wheels, tires and the plane in general, the price just about covers all of this. The model being the first prize winner in an international contest should mean something in market value."

* * *

CAN I get into aviation without money? This is the theme song of many letters that come pouring into this office. We can't say that this is impossible, for it has been done, but it is not at all probable in view of the many graduates that are being turned out by the aviation schools, trained and ready to go to work. To work yourself into aviation, via the apprenticeship route, would take a long long time.

* * *

THE British National Air Safety committee has offered these hints to private fliers:

Flying calls for care as well as courage.

If the weather is very thick, it is better not to leave than to be the "dear departed."

Your arrival should merely be the finish of a journey, and not the end of everything.

Method may take time, but—it's better to be late, Mr. Airman, than to be the late Mr. Airman.

* * *

PADDLE-WHEEL machines, we don't know what else to call them, are receiving great attention in this country and abroad. Whether this scheme will prove superior to the Autogiro still remains to be seen, but in any event it is a long and dubious step away from the simplicity and structural integrity of the fixed wing airplane. Only time can tell how the paddle-wheel or "side-wheeler" idea will work out.

* * *

WELL, we're getting down to the bottom of the page, which means that we will have to close the chat for this issue. I've had a lot to say this time, and perhaps it is a one-way column. Just as a matter of interest I intend to publish a number of interesting reader letters in August. See you then.

J. B. R.

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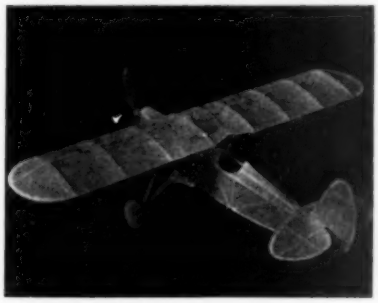

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Tony Fokker

(*Continued from page* 8)

was to be made and took firm steps.

The story of the birth of the D-VII is an important chapter in aviation history, since it proved to be the most terrifying Juggernaut hurled through the skies at an already sorely harassed enemy.

Fokker took this model to Johannisthal for the contest. Taking it upstairs on a trial flight he was amazed to find the plane a "natural" in the spin. So "natural", in fact, that a pilot from the front unused to its controls would most surely crash to his death on his first flight.

The night before the contest, Fokker moved into his hangar with several trusted workmen. They cut the fuselage in halves with a blow torch, welded in additional rigging making it longer from wing to tail, and then covered over their work with skillfully sewed canvas. Thus, the D-VII, perfect from an engineering standpoint, won the contest and took its place as master of the skies.

It was not long after this—sometime in 1916—that Tony invented and perfected the now famous triplane that bore his name. It was commonly called the "tripe" by all flyers on the Western front. Not long after its appearance it was known far and wide as the arch terror of single and dog-fight combat. In the space of a single year Tony Fokker wrote a blazing new history in aerial warfare with his D-VII and his "tripe."

Then the war ended. Sailors at Kiel mutinied. Soldiers at the front line turned to march on Berlin. The Reds shouted from soap boxes and the Reichstag was in upheaval. The revolution was on! Franz Ebert, a saddlemaker, was made president. Imperial Germany became a republic and the Kaiser fled.

Bands of revolutionists held Schwerin in a vise-like grip. A delegation called on Tony Fokker at his factory. Would he ransom himself? Yes, Tony said, he most certainly would. What value his millions of marks if he were a dead man? Most certainly he would ransom himself. Give him a few hours, he said.

That was all he needed. He slipped through their cordons and went into hiding until it all blew over. The revolution did blow over, but war hates did not. The Treaty of Versailles demanded the destruction of most of Germany's war equipment. It specifically ordered all Fokker planes and machinery destroyed.

It was at this time that what will probably go down in history as one of the world's most daring and brazen smuggling plots was executed. Tony didn't intend to lose either his planes or his machinery. The only answer was to try to smuggle what he could into a neutral country. What better one than his own?

Organizing a gang of trustworthy henchmen he began operations. From one end of the railway to the other—Schwerin to Holland—guards, trackmen, brakemen, firemen, engineers, customs agents and signal men were shamelessly bribed. Then, one dark night, six long freight trains steamed slowly out of Schwerin loaded to the rods with airplanes, engines and machinery. There were 250 planes and 400 motors on those six sections!

And they all got through!

Meanwhile, Tony put all his cash into bags and made for the border. He carried only immediate travel needs on his person. His agents were transferring his fortune. One, a cook from a certain foreign embassy, carried a dilapidated satchel containing $400,000 in bills over the line and delivered it safely to its owner.

In Holland Tony built a new laboratory and sent his steady stream of ideas to his adjoining factory to be tried out and perfected. In 1925 he brought to America a trimotor monoplane. The industry was astonished but it was quick to see that Fokker had a great idea. Meanwhile, a stunt flight put him over.

Comm. R. E. Byrd was looking for a suitable plane. He approached Fokker. Fokker said no. He had only this one trimotor for exhibition in this country and had no desire to sell. Byrd asked him at what price, all things considered, he would part with his ship. Fokker said $40,000, jacking up the price. To his surprise the check was written immediately. Fokker denies that he intended to sell it, which is not unlikely since it was the only one of its kind. But then Tony Fokker is nobody's fool.

Fokker's single-engined monoplanes had already made a name for themselves. The name Fokker first became associated in a big way with American aviation when the United States Army air corps placed an order with the Hollander. Lieuts. Oakley G. Kelly and John A. Macready of McCook Field flew a Fokker monoplane powered with a single 400 h.p. motor on the first nonstop transcontinental hop. That was in May, 1923.

Several other of the famous Dutch inventor's planes were the "Josephine Ford" (Byrd to the North Pole), the "America" (Byrd across the Atlantic) and the "Southern Cross' (Kingsford-Smith around the world).

The inventor says he made about 30,000,000 marks during the war. He has already filled contracts with the U. S. Army air corps totalling $750,000. He says he lost most of the German rewards and spikes the story that he flew his millions out of the country. He was entirely too closely guarded to get away with that, he says.

Tony Fokker, citizen of the world, still pursues his experiments in whatever laboratories are at his disposal—in case he has just sold one of his companies to some high bidder. He does plenty of flying but it has lost its zip for him, he says. Test-piloting his own ships is a duty in his opinion, and he never shirks it.

Some of his personal traits are the result of long years spent within the restricted confines of his laboratories.

But, there is one marked characteristic possessed by Tony Fokker that none can deny. He is a demon for publicity and attains publicity and the limelight as easily and simply as May West. Anything that Fokker does is front page news. It was this way during the war and has been ever since. He doesn't court publicity—it comes to him without effort. Just as an example, few of us know who designed the Spad, the Nieuport or the Camel, but all of us know the genial designer of the D-VII!

He despises walking, but is very fond of swimming and yachting. He usually manages to live in a locality where it is convenient to maintain a boat. He plays no card games and can't stand tobacco although the habit in others doesn't disturb him. He uses no liquor and can go several days without sleep. He is partial to sugar mixed in water which he finds very stimulating. And he simply can't remember figures—even telephone numbers!

He speaks Dutch, French, German and English and has taken out his first citizenship papers in this country.

END.

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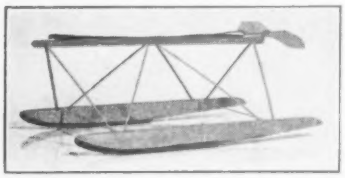

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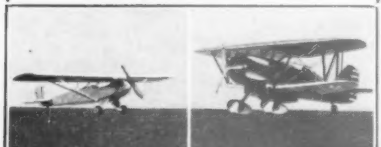

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James V. Martin

(*Continued from page* 14)

1916. Used on U. S. Navy boats H-16 and patrol boats.

16. **Shock-Absorbing Wheels.** Patent No. 1,327,478, filed 1917. Flown by Coombs at Dayton, 1919. Five other patents granted and others still pending. 1918 Army Report No. 254.
17. **Emergency Exits.** Patent No. 1,627, filed 1921. Used on all transport planes. N.A.C. 1927.
18. **Internally Braced Ailerons.** Patent filed 1919. Second Patent No. 1,334,707.

OTHER PATENTS BY J. V. MARTIN NOT SHOWN ON DRAWING

A. **First Successful Tractor Biplane in U. S. A.** Patent applied for in 1911. Held world's speed record in 1911. Took the record from T. O. M. Sopwith. This was the Queen-Martin built and flown by J. V. Martin.
B. **Passengers in Wings.** Patent filed May 3, 1919, pending 1933. Described in Gottingen Reports—a future construction.
C. **Boundary Air-Flow Devices,** basic principle of Handley Page "spoiler" and similar air-flow devices for increasing lift of wings. Two patents, Nos. 1,771,053 (1930), 1,854,706, 1922. Used on Curtiss Shrike.
D. **Engines Housed in Wings.** Patent filed 1919, pending 1933. Navy Report 227.
E. **Freeing Tail Group of Down-Wash.** Patents applied for and pending.
F. **Telescopic Wings.** Two patents granted, Nos. 1,627,191: 1,854,706 applied for in 1921 and 1922 respectively. Eiffel Laboratory, May, 1921: Curtiss Laboratory, April, 1921.

Glancing over this most surprising list of inventions by one man, we note that many supposedly new inventions are really quite old. For example, look at the patent dates for the double convex wing-section, stressed skin covering, retractable landing-gear, ring-cowling for engines and split-axle landing gears. And, the old Queen-Martin tractor type plane was well known in the old days when pusher types were prevalent. James V. Martin was a long way ahead of his time on many aviation inventions.

Shortly after the war, Mr. Martin constructed a most remarkable little plane of the high-speed lightplane order. In it he incorporated many of his ideas, but the outstanding feature was the retractable landing gear and the elastic or flexible spoked wheels. It would be interesting to dig up some pictures of this little ship and present them as a suggestion for the $700 plane. Only recently, the telescopic wing idea was brought up again in Europe and presented as something new.

END.

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Span 13½" ¼" scale Length 9⅛"

A well detailed model of this sensational 1932 speed plane,—good flyer for peculiar bulky shape. Kit has all numbers, dice, insignia, etc., printed in correct colors. Also, Red and White dopes and PRINTED WOOD, full size drawing, etc. The most complete kit of this model ever offered. Price complete **85c**

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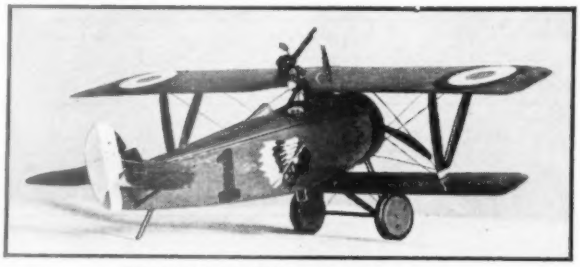
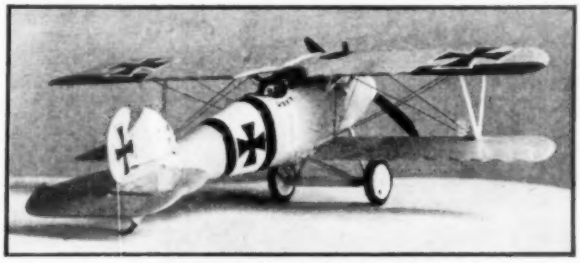


THAW'S NIEUPORT 27 C. I.

Span 11⅞", length 7⅞", colored all yellow, brown trim. Kit has cut-out fuselage, wheels, cowling, stamped wings, tail, prop, wire riggings, 4 bottles brushing lacquer, **bottle of wood filler** for glossy paint job, paint brush, sandpaper, dashboard, windshield, motor, construction drawings, controls, insignia, movable rotary engine and Lewis gun. **COMPLETE KIT** ..... **$1.25** P. P.

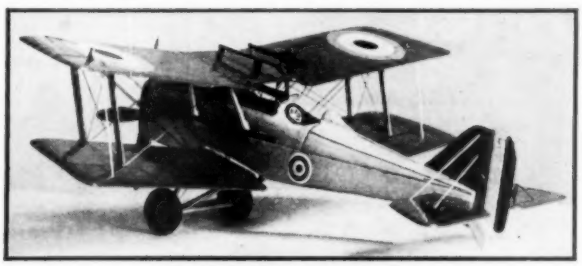


UDET'S ALBATROS D-5

Span 12¾", length 10½", colored all blue, black and white trim. The famous Bavarian Blue Tails leader's plane. Kit has cut-out fuselage, wheels, stamped wings, tail, prop, wires, Mercedes engine, movable controls, dashboard, windshield, insignia, detailed drawings, with glue, paint, wood filler, brush, sandpaper, etc. **COMPLETE KIT** ..... **$1.25** P. P.

RICHTHOFEN'S FOKKER TRIPE

Span 11", length 8¼", colored all red, white trim. Kit has stamped wings, tail, prop, cut-out fuselage, wheels, cowling, wire rigging, 4 bottles of lacquer, wood filler, glue, brush, sandpaper, dashboard, windshield, motor details, crosses, detailed drawings, movable controls, etc. **COMPLETE KIT** ..... **$1.25** P. P.



McCUDDEN'S S. E. 5A

Span 11⅝", length 8½", colored yellow wings, blue body. Model of famous S.E. 5A. Kit has cut-out body, wheels, stamped wings, tail, prop, wire riggings, insignia, control details, guns, dashboard, windshield. 4 bottles lacquer, wood filler, glue, numerals, tail in colors. A Real Scale Model. **COMPLETE KIT** ..... **$1.25** P. P.

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The AUDITORIUM HOTEL CHICAGO

The "Alerte"

(*Continued from page 35*)

The profile frictional drag coefficient C_{D_o} is obtained by subtracting the induced drag coefficient from the wing drag coefficient. Airfoil characteristics of the Clark Y in tabular form are easily obtained.

* * *

(5) One of the most difficult items to estimate in performance calculations is the parasite drag. The summary of the drag of all the different parts of an airplane exposed to the air stream is not very accurate because of the unknown effect of interference. The following system nevertheless gives fairly good results.

The first step in determining the parasite drag is to work up a form as shown in Fig. 5, summarizing the resistance of the various structural members and other items exposed to the airstream (Table A).

The thickness and length of struts, wires, etc., may be taken from the projected view of the front of the airplane (see front view in preliminary sketch). The drag of a fitting, including its interference drag, may be considered as being double the projected area of that fitting. That is, if a fitting has an area of 2 sq. in. exposed to the wind, its interference effect will also be equal to 2 square inches, making the total 4 square inches.

The drag per square inch of projected area of an object at 100 M.P.H. may be safely figured as being .22 lb. This applies to a dead flat area only. Ordinarily, in airplane work, it will run less, depending on its shape. How-

Figure 5—TABLE A

STRUCTURAL DRAG at 100 Miles Per Hour

Member	Number N	Length L feet	Size t inches	Total NxL	Drag/ft. 100 m.p.h. lb.	Total Drag
Cabane Struts	4	1.25	1.00	5	.195	.975
Interplane Struts	2	7	1.00	14	.195	2.730
Flying Wires	6	7	.312	42	.150	6.300
Cabane Wires	4	3	.312	12	.150	1.800
Landing Wires	4	5	.312	20	.150	3.000
Landing Gear Struts	2	3	2.000	6	.370	2.220
Horizontal Tail Struts	2	4	.625	8	.170	1.360
Fin Brace Wires	4	4	.250	16	.150	2.400
Tail Skid	1	1	1.125	1	.225	.225
						20.710

Figure 5—TABLE B

SUMMATION OF PARASITE DRAG at 100 Miles Per Hour

Parasite Drag Varying With Angle of Attack (P_1) Member	Number	Area in Sq. Ft.	Drag per Sq. Ft.—100 m.p.h.	Total drag lbs.—100 m.
Fuselage	1	7	4.	28
Tail surfaces		24	0.4	9.6
				37.6
Parasite Drag Constant With Varying Angle of Attack				
Structure (Table A)				20.7
Wheels	2	22x10	9.25 each	18.5
				39.2

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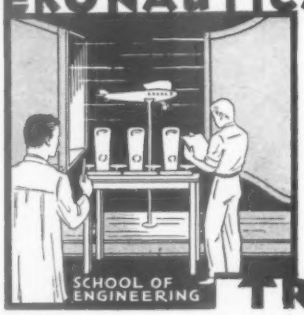

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ever, as a matter of corrective allowance, for estimating purposes, this figure may be used. This and the values given in Table A are taken from wind tunnel data.

Having made up the form in Fig. 5, we can proceed as follows:

Equivalent Flat Plate Area (Ae)= (P_1) plus (P_2)

$$Ae\ (P_1)=\frac{37}{.00327\times10000}=1.13$$

$$Ae\ (P_2)=\frac{40}{.00327\times10000}=1.22$$

Total Ae=2.37

The parasite drag coefficient C_{Dp} at High Speed is

$$C_{Dp1}=\frac{37\times892}{150\times10000}=.0090$$

$$C_{Dp2}=\frac{40\times392}{150\times10000}=.0104$$

Total parasite drag C_{Dp}=.0194

* * *

(6) To determine the amount of power required, the following equation is generally used:

$$\text{H.P. required (at sea level)}=\frac{C_D\ S\ V^3}{147{,}000}$$

Power requirements at various altitudes may be ascertained by more elaborate computations, which, however, lack of space does not permit us to go into. On a broad average, it may be stated that for every thousand feet increase in altitude, an increase of about 3 H.P. is required to maintain a constant speed.

Reverting to the above equation, we have a total drag coefficient (C_D) as follows:

Profile drag (C_{D_o}) Clark Y	=.0090
Induced drag (C_{D_i})	=.0007
Parasite drag (C_{D_p})	=.0194
Total drag coefficient	.0291

Therefore the equation resolves into:

$$\text{H.P. required}=\frac{.0291\times150\times3{,}375{,}000}{147{,}000}=100$$

While this comes out to exactly 100 H.P. this figure is too high, inasmuch as we can only hope for about 80% of this power to be actually delivered to the propeller and thereby turned into actual pulling power.

EDITOR'S NOTE. We have now made our preliminary estimate on the performance which show that alterations must be made at various points to reduce the power consumption. In the next article of this series, the author will show how this may be accomplished.

As it is impossible to publish the properties of many wing in these articles, or to give elementary information on the subject of design, we suggest that our readers send to the Advisory Committee on Aeronautics, Washington, D. C. for the book on wing sections or obtain a copy of Carter's "Simple Aerodynamics" from the Ronald Press.

Aero-Sportswomen

(*Continued from page* 18)

to be included in the final reckoning, it has been good experience and a lot of fun.

* * *

LAURA INGALLS of New York, has added one more magnificent achievement to the record of women flyers, by her recent 16,000 mile flight around South America and back.

Starting from Glenn H. Curtiss Airport, North Beach, L. I., on February 28 in her Lockheed Air Express, she left Miami on March 8 for Havana. She stopped in Yucatan, Nicaragua and Honduras, then on March 13 she flew non-stop from Cristobal in the Canal Zone to Talara, Peru, thence to Lima, with two stops between there and Santiago. On March 21 came the great adventure of flying across the Andes, and then on to Buenos Aires, Rio de Janeiro, around the coast to Natal, Para, to the mouth of the Amazon, Dutch Guiana, and to the West Indies and Miami, to New York again.

Besides being the first solo flight around the continent of South America by any pilot, man or woman, it was the first solo flight made by a woman flyer from North to South America. It was the first time an American woman had conquered the Andes.

END.

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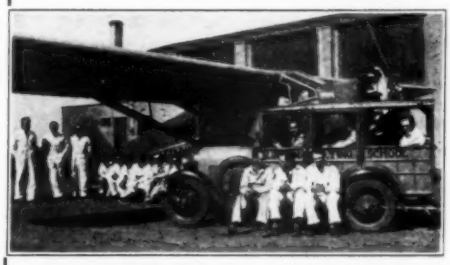

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Waco "D"

(*Continued from page 37*)

should be shaped and cemented to the motor. Paint cylinders black, crankcase aluminum, push-rods aluminum other small detail—black.

LANDING GEAR

Select a fairly strong grade of balsa and shape all landing gear struts to a streamline section. Small pieces of piano wire are cemented to the front and rear struts, which in turn are received by bushings cemented in their respective positions, as shown on plan.

The shock absorber is formed from a piece of .029 piano wire, this is cemented to inner struts. Where piano wire forms an arch, the top of which projects slightly into bottom of fuselage is fastened in no way, as this is the bending part of the shock absorber.

Cement wire securely to struts. The streamline wheel coverings are cut to shape and built up in three sections. Carefully carve and sand to a streamline form, so that they may be cemented to landing gear struts. Please note: Fillets between struts and side of streamline wheel coverings are carved and sanded from balsa.

CONSTRUCTION OF WING

Cut all ribs from 1/32 inch sheet balsa. Lay a sheet of wax paper on the plan and pin leading and trailing edges and center spar in position. The ribs are now placed in an upright position in their proper locations and cemented.

Make wing tips as shown on plan from 1/16 inch sheet balsa. We recommend this type of wing tip, as it is far simpler to construct and neater in appearance.

The ailerons are now built into the panels. Ailerons will eliminate the need for building "wash-in" into wing. We recommend that you build your model with all movable controls, as you will need these to control your model under flight. Aluminum hinges are cemented into position after wings, etc., have been covered with tissue.

TAIL GROUP

This is made entirely of balsa and is constructed upon the plan. Cover each part separately with tissue in much the same manner as the wing. Aluminum hinges are cemented into position after framework has been completely covered, so that the tissue will be taut.

COVERING FUSELAGE AND WINGS

In covering fuselage cover in long narrow strips, from front to rear, as this is the only way in which a smooth covering job will be obtained. When completely covered, shrink tissue with a coat of water, when thoroughly dry, give two coats of clear dope.

Fillets for lower wing panels are now carved and fitted to lower part of fuselage. Please note: opening in lower front part of body. This is for pilot to see through when viewing objects below and in front. Cover openings with a thin sheet of celluloid.

Wings are covered with larger sheets of tissue as wrinkles are not apt to take place on larger surfaces. Cover top of panel first, and finish up by covering bottom. Shrink and dope in same manner as fuselage.

FINAL ASSEMBLY

The finish on the other parts of the model will be greatly improved by giving them three or four coats of banana liquid, so that they will have a glossy finish when painted. Cement all cabane or center section struts in position to receive upper wing panel.

Cement wing panels to these struts making sure you have the proper alignment. The lower wing panels are cemented to the lower fillets. The end struts and their fillets are cemented in their respective positions.

It is a wise stunt to block the ship up in flying position when cementing these different parts, as you then can obtain the proper alignment of the wings, etc. Use a needle and thread in installing all flying, landing and bracing wires.

BOMBS AND MACHINE GUNS

By careful confirmation to plan there should be no trouble in the construction of the two bombs and bomb racks. Note the release mechanism. The machine guns are fully detailed also. Machine gun in cockpit being removable.

END.

Curtiss Army Hawk P6E

24" Span, Weight 2¼ oz. Flies 800 Feet

The strongest and most perfect model of the P6E on the market, has squadron insignia on pants and fuselage, metal exhaust pipes, aluminum wheels, 2 color dopes, all parts printed on balsa, printed instrument board, semi scale, Fibre prop. Const. Set Complete. Postpaid $2.50

5 Foot Curtiss Hawk P6E

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Specially designed for Gas Motor. Const. Set Complete. Postpaid.....$28.50

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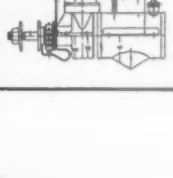

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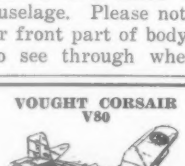

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22½" Span, Weight 2¼ oz., Flies 750 Feet

Set contains 3" celluloid motor, aluminum drag ring and motor plate, ribs and formers printed on balsa, celluloid wheels, silver discs, wing rudder, Army and fuselage insignia, semi-finished prop., Yellow and silver dope, glue, drawing and all materials.

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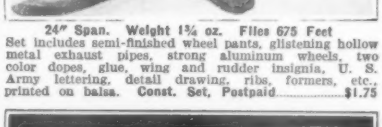

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AIRPLANES

FOR SALE or trade, an Aeronca C-2 with less than 70 hours on the late type motor. Prefer a car, but would consider a good motorcycle.—Clarence W. Trost, Rice, Kansas.

I HAVE a sport Renault, cost $14,000.00; Packard twin sport roadster like new; Hudson Brougham, '27; two Macks and Auto Car Trucks 3½ tons, licensed for seven, hydraulic dumps, only used two years, cost $5,500.00 each new; will sacrifice in trade for two place light plane open or cabin; am moving to warmer climate. —Burlew's Garage and Machine Shop, Brielle, N. J.

TRADE or sell—Waco 9—150 h.p. Curtiss K-6 excellent shape, covering good, landing gear bent, prop broken. Cash $80 or trade on small ship and pay difference.—W. H. Michaud, Beaverton, Mich.

PITCAIRN PA-3 airplane, powered with OX-5, in fine flying condition, new flightex covering and new propeller, finished in yellow and blue. This ship is a 3 place job, handles nicely and lands slow. Will sell, or trade on late model car, or J-5 or Warner powered job. Send picture with your offer.—Watson S. Eaddy, Johnsonville, South Carolina.

IN ONTARIO—Have Ford '31 Deluxe roadster. Will trade for Airplane in flying condition.—Box 1, c/o Popular Aviation.

WANTED for cash, Curtiss Robin with radial or OX engine. Must be licensed or 3 place Bird. What have you?—Geo. F. Kunze, Sleepy Eye, Minn.

HAVE damaged International Biplane, repairable, at $25.00 as is, less engine, or will accept trades in light aircraft. Also have an OX-5 engine in good condition at $35.00 or will trade for repairable light aircraft parts.—Theodore Ledford, 644 Dayton St., Hamilton, Ohio.

WANTED, Any plane in flying or cracked condition, aeroplane motor with prop. under 100 h.p. Have some cash and Johnson 32 and Dodge 38 marine motors in A-1 condition; several boat parts; 300 mags. including several Pop. Aviation, Aero Digest, Pop. Mechanics, Pop. Science and two Flying Manuals; German glider plans; splend sun lamp.—C. Bickelhaupt, 301 Thirteenth St., Port Huron, Mich.

I WANT a light plane with or without motor. I have a good Indian cycle chief with sidecar; Harley and Indian motor; picture on request. Can also buy ship if cheap.—Pete Gotchel, 1839 So. 6th St., Camden, N. J.

FOR SALE or exchange, American Eagle 3 place biplane millerized OX 5 very clean and little time, now identified but licensable; interested in Russell or Irwin training outfit or 2 single chutes.—M. J. Polasky, P. O. Box 221, Byesville, Ohio.

WILL trade for Barling NB3 complete less motor or will pay cash.—L. J. Perry, Harley Davidson Sales, Kalamazoo, Mich.

WANTED—Two place licensed lightplane, good condition. Trade 1929 Chevrolet touring, fine motor, new top, good tires, 1934 license. Also 50 dollar autotent, two new cots and campstove. Add 25 dollars cash.—W. B. Joslin, Adrian, Mich.

WILL trade Lambert 90 Kari Keen, 2 place cabin monoplane A-1 shape, 250 hours, just relicensed, motor just major overhauled. Value $1,500. What have you?—Harold Clober, New Ulm, Minn.

LATE Davis Monoplane Leblond 65. 225 hrs. total time. Will trade for licensed OX5 and cash around $225.00.—L. J. Perry, Harley Davidson Sales, Kalamazoo, Mich.

WILL exchange Remington Model 34, .22 Cal., 16-shot rifle, chrome plated speed bolt, about two thousand Winchester shells for same, Majestic 6-tube auto radio Model 16A, some cash, for light plane in flying condition. Send photo of plane and full details to Irv'n E. Tylor, 1609 N. Milton Ave., Baltimore, Md.

WANTED any airplane that will take Leblond 65 engine. Have many things to trade or will pay cash.—L. J. Perry, Harley Davidson Sales, Kalamazoo, Mich.

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BRAND new 24x4 wheels, tires, tubes and axle. Will trade for new 20x4 wheels, tires, tubes and axle and what have you.—L. J. Luchun, 306 E. Centre St., Shenandoah, Penn.

WANT the following parts—Welded steel Heath or Church Fuselage; Tail Assembly; Kanding gear, wheels and tires. Have to trade all kinds of radio transmitting and receiving parts, television parts, etc. Would consider any type of unfinished LIGHT PLANE and MOTOR. Cash difference.—Write Post Office Box 195, San Antonio, Texas.

TRADE electric steam engine, racing model for late issues of Aero Digest or Sportsman Pilot. —Estel Davis, Reeds Spring, Mo.

HAVE newoak prop, fits Anzani 35 h.p. Want Salmson 45 h.p. prop or cash.—C. Klinefelter, McDonogh, Md.

TWIN outboard engine wanted in good running condition. Have good Stewart Warner short wave set easily worth $25.00. Add cash if necessary.—Tommy Carlisle, Crestline, Ohio.

HEATH-HENDERSON motor factory built, only flown 6½ hours, Heath fuselage, set tail surfaces, set ailerons, all covered and in A-1 condition. Want light car or truck or cash.—C. M. Petrie, Kremlin, Mont.

TRADE fine cornet-trumpet for OX. Want J5 Stearman rudder, upper wings, other parts, any condition. Have LeBlond 60, complete light plane fuselage.—A. Miller, 10 Willard Place, Montclair, N. J.

NEW AIR camper fuselage complete with all steel landing gear (except axle and wheels), tail skid, motor mount, complete dual controls, throttles, seats upholstered, oil gauge, practically ready to cover and fly. Also 3 exhaust port head to convert Chevy motor with 1⅝ in. valves, stacks, larger intake manifold 1¼ in. Zenith carburetor, and 2 to 1 ratio rockers. New 6½ ft. walnut copper tipped propeller with hub. Will trade above for good 4 cy. motorcycle in good running condition, or, a good 4 cy. motorcycle engine with reverse gear, cash to boot, or, a good used piano accordion with at least 60 basses.—Write W. Ford Lehman, Mt. Eaton, Ohio, c/o Younkers Garage.

WILL swap complete Standard Lionel electric train; nothing more needed; just overhauled. Worth $80.00. Want model gas engine in running condition.—Clark Pardee, Wilbraham Academy, Wilbraham, Mass.

FOR SALE or trade—1 new Dayton 4 cyl., air cooled motor. Advertised in 1933 Flying Manual. Will trade for Heath Center Wing Fuselage and landing gear. If used must be undamaged. Motor cost $250 as is. For details write—R. W. Thompson, East Dayton Airport, Dayton, Ohio.

HAVE Burgess Seaplane pontoon just refinished. Want lightplane engine or "Scout" parts.—Fred L. Webber, R. F. D. 2, Newport, R. I.

WANTED "B" battery eliminator that supplies 45 volt "B" current from 6 volt storage battery. What do you want?—Arnold Holden, Bucyrus, North Dakota.

GLIDERS—BALLOON

WANTED GLIDER: Will trade $40 flute, new $15 .22 cal. rifle, $5 wrist watch, and $50 diamond pin, and $10 new life jacket and revolver. Also want a plane.—Albert Haley, 20 Franklin St., Marblehead, Mass.

FOR SALE OR TRADE: Evans primary all steel construction glider with 150 ft. steel wire, some tubing and tow rope. Want outboard or inboard motor or reasonable cash offer.—Winn Ross, Jr., Rochester, Ill.

WANTED—Any kind of balloon capable of carrying as many as three passengers or bag for a free balloon. Will trade motorcycle plus cash.—J. Johnston, Box 1135, Jacksonville, Texas.

MISCELLANEOUS

DEEPLY interested in aviation career. Will do any kind of work around airport as apprentice for board and room. Age 22, three years college pre-engineering, A-1 references. — Billy Kent, Braddyville, Iowa.

A YOUNG fellow of 16 is willing to work hard on any air field until Oct. 20 in exchange for board and instructions in flying or motors. Have had preliminary training. 6.3 tall—155 lbs.—Herbert Kindt, Hartford Ave., New Britain, Conn.

GIRL nineteen, private pilot, chute jumper, wing-walker, attractive personality, nerve, educated, go-getter, small, will exchange services for flying time or small salary or what have you? Will travel anywhere. Anything relative to aviation considered. References exchanged.—Alice Levinson, 407 W. Goodwin Ave., Victoria, Texas.

YOUNG MAN 19 will work anywhere in U. S. for flying lessons, room and board or anything pertaining to aviation.—Glenwood Proefrock, 1049 Nash Road, North Tonawanda, N. Y.

WANTED—E-flat saxophone in good condition. Have wrist watch, electric motor, kodak, and aviation books to swap. Remainder in cash.—Max Caldwell, Box 134, Axtell, Kansas.

HAVE Funk & Wagnalls New Standard Dictionary to trade for smaller dictionary and some books, or tools, etc.—Robert Ruppel, 9 Jerome Street, Brooklyn, N. Y.

HAVE Civil War rifle working order. 7-shot Derringer 22. Vest pocket kodak. Want bike, gas or compressed air engine. Write Ralph Anderson, 7321 South Park Ave., Chicago, Ill.

AMBITIOUS young man of 19 (high school graduate) very much interested in aviation. Will exchange work, parachute jumping or anything else for flying instructions. Will go anywhere.—Joe C. Peterka, R. No. 1, Box 67, Wilson, Kansas.

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EXCHANGE liberal interest in profits from gold mining plus wages for help in opening and operating said mines.—Dr. DeHesse, 2544 E. 79th Street, Chicago, Ill.

YOUNG man 19 will fly or work 3 years at $30 per month and board for anyone who will finance me through a commercial aviation course. Write Edwin Lewis, 315 N. West Street, St. Marys, Ohio. References.

MOTORS

ONE-CYLINDER motorcycle motor transmission and clutch. Want an outboard motor.—Frank Likut, 2900 Carson Rd., St. Louis, Mo.

LEBLOND 65 motor prop and hub to trade for licensed OX5 job or will sell reasonable. Also a brand new licensed Heath B4 motor to trade. —L. J. Perry, Harley Davidson Sales, Kalamazoo, Mich.

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HARLEY DAVIDSON motorcycles to trade for your airplanes or will pay you cash. Ships must be complete. Also good buy in Harley Davidson motorcycles and used parts.—L. J. Perry, Harley Davidson Sales, Kalamazoo, Mich.

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POPULAR AVIATION

608 S. DEARBORN ST. CHICAGO, ILL.

Busted Birdman

(*Continued from page 28*)

me twice a year anyway. He's a good one—"

"You can't. Gotta see these. Department of Commerce says so!"

"Why?" Ollie asked meekly. "I thought all doctors had to know when people are well and when they aren't, before they're allowed to practice and for just a student's permit—"

* * *

THAT argument lasted a long time. It ended up with Ollie headed for the prescribed medico. He found his man in a dusty, two-by-four office, practicing golf shots with a waste-basket as a cup.

"Happens I got time to give you the works now," the doctor said. "Take off your shirt. Ever any insanity in your family? Any epileptic fits? Ever faint? Stand on one leg and count twenty with your eyes shut. Walk in a straight line with your eyes shut. Now in a circle."

The doctor thumped Ollie's chest and counted his ribs.

"You're in good shape," he commented. "Now about those eyes. Stick your head into this machine. It'll test your skyhootin' equanimity to a frazzle. If you can fly, your nose'll stick past this marker—"

Ollie obeyed. The doctor shook his head. "Too bad. You'll never make a flyer. Your visual acuity is wrong. Twenty-forty in one eye and fifteen-five in the other. You can't fly."

Ollie twisted his hat savagely. "Why can't I fly? You haven't tried me in an airplane yet! I can drive a car swell: never had an accident. I'm the champion target-pistol shot of—"

The doctor, who was baldheaded and sweaty and whose main interest was politics anyway, grunted.

"Statistics prove—"

"Did *you* ever do any flying?" Ollie demanded.

"Me? Hell no! Couldn't get me into one of the things, myself!"

"Then how come you know so much about who can fly and who can't? People drive cars at sixty miles an hour on the highways, missing the other fellow's fender by two or three feet—and twice sixty is one-twenty, the speed they pass each other when they meet. They do that without taking fool examinations."

Ollie's one sin, his temper, was getting away from him. "Anyway," he said wildly, "I don't want to carry passengers. I just want to fly myself. And how come a fellow with one eye flies a fast ship around the world without cracking up, and does it twice? Don't these licensed guys with the super-eyesight crack up as often as anybody else? How—"

The doctor reached for a pad, and jotted down some figures.

"Put your shirt back on," he suggested. "That's all. The test says you can't fly, and that's that. Ten dollars."

"What for?" Ollie asked curiously. "My doctor gives me twice as much examination for two and half."

The medico spluttered, but didn't manage to say anything.

"Maybe I'll get my license anyway!" Ollie said, nettled.

The doctor looked up with interest. "Got a relation in Congress?"

"No—why?"

"Then you'll never get a license. Don't waste your time writing in to the department. Good-bye!"

* * *

OLLIE was beginning to feel the way the Mongols felt when they ran up against the Great Wall of China. He wandered back to the airport in somewhat of a daze and found himself in the office of His Highness, the well-paid inspector.

Ollie was resolved to keep his temper this time, though. He only wanted to ask a few questions to satisfy his curiosity.

"The doctor says I can't fly, Mister Inspector. But I wonder, if maybe I could license my ship, and hire somebody with a pilot's license to fly it and test out my flexible-wing ideas—I think I could sell that idea to some big company. I got a patent—"

His Highness shoved a form-sheet across the table. "You gotta get a stress analysis. Got to have an engineer make that. He's got to be a good engineer, and it's got to be up in good shape, so the boys back in Washington can understand it."

"What will that cost me?" Ollie wanted to know.

"Oh, something over two hundred bucks. Then we test your—"

Ollie stood up. "Say, that's as much as the whole ship cost me! Who owns the sky, anyway?"

"Makes no difference. This state has good air laws. Before you make a move, you gotta have a license. We're clamping down on unlicensed, wildcat flyers. Gotta protect the public." His Highness picked his teeth with the sharpened end of a match.

"But," Ollie protested, "I'm not going to carry passengers in my ship, and I'm not going to build ships to sell! I'm only trying to test out my ideas in flight, and fly for sport. If I want to break my neck, that's my business, isn't it?"

"Not in the law it ain't. You gotta have a license. And don't get fresh with me neither. I don't have to stand for it."

"Who pays you and who picks the doctors that soak us student pilots as much as they soak transport flyers?"

"Department pays, and picks the doctors."

"Which means the public pays you. And you turn around and tell the public it can't fly for its own amusement and for experiment. If it flies, it has got to fly with the big airlines. Something stinks around here."

"You flunked the physical: then

shut up. You aren't fit to fly. And your ship is worse."

Ollie flared. "Oh it is, is it? Well, I've noticed quite a few licensed ships cracking up with licensed pilots at the stick; more, I bet you, than unlicensed ones, in proportion. Why, in Frisco an approved ship exploded and set two houses on fire when it came down! Burned up a lot of people; and none of us sport flyers would be doing that. It's our own necks we're risking, and it looks to me like it's our own damn' business. If I was going to fly passengers, or build ships to sell I wouldn't kick a bit—the more regulation the better. But—"

His Highness put his fingertips together complacently. "This state," he repeated, "has excellent air laws. And they're going to be enforced. We're clamping down on you wildcat flyers, and putting on new men to do it! We've got a lobby working on the governor to get him to enforce the law even more strictly—"

"Which," Ollie yelled, "means more jobs for you and your political friends, and more of the taxpayers' money thrown away keeping the taxpayer out of the air!"

"Oh, no," quoth the Last Word in aviation law, "everything is straightforward and legal in every respect. And, my friend, when you start talking about tax-payers, you're not the only tax-payer by a heck of a sight. What about the big airlines that we've got to protect against a bunch of flivver flyers?

That burned Ollie up, but what was the use? His opponents had everything on their side, power, pull, money and the right to regulate the restrictions. What was the use?

* * *

WHICH concludes the sad little fable of the Forgotten Airman, folks. Ollie left the inspector's office in a dangerous mood. He thought things over for a while—during which time he seriously considered going to the South Seas and establishing a sanctuary for persecuted amateur aviators on some lonely island.

Then he finally went out of control completely, and bought himself a supply of nice red tape and a pistol, tied himself to the ground with the red tape—and made headlines in the morning papers.

AUTHOR'S NOTE!

Dear Editor:

Should you decide to run this, it might be well to drop in a footnote stating that I hold Student Pilot's permit No. 21266, now ***expired and*** *wilted with long disdain and neglect, and have plenty of time for a private license, which I refuse to get. There is nothing the matter with my eyes. These facts might thwart the cry of "Sour Grapes!" should it arise in certain quarters.*

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END.

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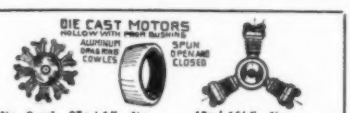

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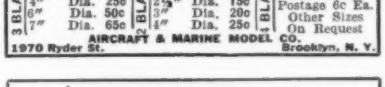

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Engine Quiz

(*Continued from page 34*)

Q. Is it desirable to have 100 per-cent. carbon dioxide?

A. *No. This would indicate that too much air was being used. Excess air causes more waste than incompletely burned fuel.*

Q. How can you judge the mixture by observing the exhaust?

A. *If the mixture is too rich (too much gasoline and not enough air), it will not burn completely. This is indicated by black smoke and a sooty red flame at the exhaust. If the air is in proper proportion, the exhaust will be smokeless with a violet colored flame. If too much air is being used, the exhaust will be smokeless with a bright green or blue-green flame.*

Q. What does white or blue-white smoke indicate?

A. *This indicates that the lubricating oil is burning due to an excessive amount of the oil or to overheated cylinders.*

Q. Does the lubricating oil burn?

A. *Yes, because the burning point of lubricating oil is about 500°F. while the average temperature of the gases to which it is exposed, averages about 900°F. The reason that oil exists at all in the cylinder is due to the fact that half of the oil film is in contact with the cool cylinder walls while the other is exposed to the gas.*

Q. Then, if lubricating oil burns, it must give some power.

A. *It does. When an engine becomes badly overheated, it will sometimes continue to run with the gasoline supply and ignition entirely shut off. This is due to the lubricating oil, and under all conditions, some heat is supplied by the "lube."*

Q. Are there any combustion losses?

A. *One, known as the "exothermic reaction" is a loss caused by heat absorbed within the fuel itself while burning. This is comparatively small but it exists.*

Q. What happens when low grade fuels are burned, low grade gasoline, kerosine, etc.?

A. *It is difficult to properly vaporize these fuels, and in addition, the vapor is so heavy that it will not mix with the air as it should. The result is incomplete combustion, smoky exhaust, deposits of soot and carbon on the interior of the engine. Detonations and knocking also take place. In spite of the fact that such fuels may cost less per gallon, they are often the most expensive because such a small portion of them is burned.*

Q. But heavy oils, kerosine, Diesel oil and fuel oil are burned in Diesel engines.

A. *True enough, but up to the present time we have been discussing the carbureting type of aviation engine that is most commonly used at the present time.*

Q. What is the difference between the carbureting type and the Diesel type engine?

A. *In the carbureting type engine, the volatile gasoline is sprayed and vaporized in a device called the "carbureter," and the resulting mixture of gasoline vapor and air is drawn into the cylinders. Here the mixture is compressed and ignited by an electric spark.*

The Diesel, or the "Self-Ignition engine" compresses pure air to a very high pressure. The oil is then sprayed into this red-hot air by a pump, and as soon as it contacts the air, the fuel burns. No mixture is compressed at any time, hence there are no detonations.

Q. Since the "Self-Ignition," Diesel Engine, or Compression-ignition engine has no carbureter nor electrical ignition system, it must be much simpler and more reliable than the gasoline engine.

A. *No it is not. The complicated and delicate little fuel-pump and the equally delicate nozzle, together with the difficult lubrication, makes this engine no better than the gasoline engine so far as reliability is concerned.*

Q. Is there a difference in the combustion methods?

A. *Yes. The oil is sprayed into the hot highly compressed air in the Diesel engine, and burns during a considerable portion of the working stroke at a fixed pressure that is very little higher than the compression pressure. Since this pressure is fairly uniform for a portion of the stroke, the Diesel engine is also known as a "constant-pressure engine."*

Q. Are there any fuels that have a higher self-ignition temperature than gasoline so that they can be compressed to a highway pressure?

A. *Yes. Alcohol can be used with a compression of about 250 pounds per square inch and benzol can be operated at about the same pressure without trouble, but they are too expensive and hard to obtain. Even though the heat content of alcohol is much lower than gasoline, it frequently shows better results because of the higher compression permissible with the alcohol.*

END.

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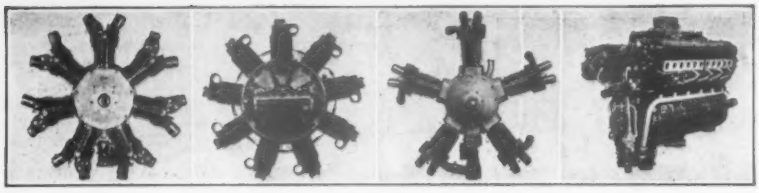

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